

CONCEPTUAL MODELS

IN

INDUSTRIAL DESIGN

BY

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## ABSTRACT

The thesis starts from the proposition that mismatches and misconceptions exist in the world of Industrial Design.

It suggests that these could be minimised if they were identified and brought into public scrutiny. The problem therefore is to articulate any differences.

An historical approach to Industrial Design draws parallels between the present situation and past periods of economic and social flux in relation to Industrial Design.

A theoretical approach discusses Cognitive Psychology and categorization and defines the term "conceptual model" as used in the thesis.

A statistical approach uses a unique combination of Multidimensional Scaling Analysis and Loglinear modelling. The former seeks to identify and distinguish conceptual domains; the latter, using the conceptual domains posited, seeks to model the way the domains are linked and the strength of the associations.

Conceptual models are described, particular to various groups: Students, Lecturers, Designers, Manufacturers, Institutions, Classes of Degree. The variations between models is taken to reflect mismatches between groups.

The conceptual domains identified were: Abstract or Higher Order Skills, Visual and Verbal Skills, Knowledge and Knowhow, Attitudes at Work, Values.

The largest differences in conceptual model emerge between two broad groups: Educational and Commercial.

A normative approach uses measures of value judgement, nonverbal intelligence, and personality to compare the Industrial Design student with his peers. Design is average in values, on a par with other undergraduates in intelligence, but, together with Fine Art students, more anxious and sensitive.

Conclusions drawn include the following:

The Industrial Design syllabus needed enrichment, especially in the Provincial Institutions, and a larger component of practical business knowledge and interpersonal insight training.

The Management syllabus could include a Design element.

More interaction between Education and Industry was essential to "educate" Manufacturers towards a greater autonomy for the Industrial Designer.

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# LIST OF SPECIAL ABBREVIATIONS USED IN THE TEXT

|           |   |
|-----------|---|
| A         | Attitudes at Work                                 |
| ANX       | Neuroticism (in EPQ)                              |
| B         | Business Studies                                  |
| CLASS     | Class of degree in BA Industrial Design           |
| DOM       | Dominant Value (in SSV)                           |
| EPQ       | Eysenck Personality Questionnaire                 |
| EXT       | Extraversion (in EPQ)                             |
| FA        | Fine Arts   |
| H         | Higher Order Abilities (in SD)                    |
| HAV       | Higher Order Abilities, Attitudes at Work, Values |
| I         | Educational Institution                           |
| ID        | Industrial Design                                 |
| K or KNOW | Knowledge or Knowhow (in SD)                      |
| M         | Mathematics                                       |
| MCM       | Meta Conceptual Model                             |
| MDS       | Multidimensional Scaling                          |
| MSA       | Multidimensional Scalogram Analysis               |
| P         | Presentational Skills (in SD)                     |
| PRES      | Presentational Skills (in SD)                     |
| PRG       | Pragmatic value (in SSV)                          |
| PRT       | Pattern Recognition Test                          |
| S         | Social Work                                       |
| SD        | Survey of Design                                  |
| SOC       | Social Value (in SSV)                             |
| SSA       | Smallest Space Analysis                           |
| SSV       | Solomons' Survey of Values                        |
| THEO      | Theoretic Value in (SSV)                          |
| UCM       | User Conceptual Model                             |
| V or VAL  | Values and Orientations (in SD)                   |
| VERB      | Verbal Presentational Skills (in SD)              |
| VIS       | Visual Presentational Skills (in SD)              |
| VVK       | Visual Skills, Verbal Skills, Knowhow             |

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## CHAPTER 1

### INTRODUCTION

#### 1.1 The Reasons for the Study

Design as a global concept, and Industrial Design as one aspect of it is of importance in this accelerating world of technology. Design as such in the sense of craftsmanship, a pragmatic aesthetic, is presumably as old as civilization and possibly as old as the tool. Industrial Design however is younger and the very term emerges only with the Twentieth Century and is a child of what may be called the late Industrial Revolution.

Modern Industry characteristically splits a complex process into specialised tasks. These tasks contribute eventually to the finished product. Many people are actively involved - the practitioners of Industrial Design. These range from the debutant Student of Design, the Lecturer and sometimes the Lecturer/Designer, the freelance and consultant Designer, the in-House or Staff Designer, the various specialists involved in Production, Finance, Marketing, Legal aspects of Industry. Not only are the various processes and procedures more specialized and more complex, but the priorities which these people acquire in connection with the product and its Design are not identical.

What is more, apart from research which highlights differences between the Design needs of manufacturers (Hayes 1983), these priorities are not sufficiently articulated and generally understood by each of the above groups.

It is at this general lack of understanding that the study is aimed, and at the consequent friction and mismatch with its effect on economic efficiency. Even if the differences between the priorities of the groups cannot fully be reconciled, say between those of the Manufacturer and the Design Lecturer, the fact that any differences have been articulated and brought out into the open is an advance.

The danger is at the same time linguistic and perceptual. Because the term Industrial Design exists, the temptation is to regard it is an entity understood by all. It is possible also to perceive the Design situation in a highly selective manner, but not to be aware in what respects it conflicts with the perception of others.

The study therefore tries to examine the manner in which the process of Design is viewed by the various practitioner groups and the way in which priority is apportioned. The pattern of meanings and concepts is termed the conceptual model and before embarking on the study proper a discussion of the theory of conceptual models is included.

### 1.2. Some basic questions

The questions which this study confronts are therefore:

What is understood by Industrial Design?

Given a basic list of behaviour characteristic of Industrial Design in what ways, if any, do groups involved in this activity vary?

Given that Industrial Design groups - Designers, both Consultant and In-house Designers, Manufacturers, Students of Design, Lecturers of Design - each have their own particular concept of what Design activity is or should be, how may these mental models be revealed or articulated or brought into public view, so that any mismatches or anomalies be highlighted?

The other, perhaps more fundamental question, which is the *raison d'être* of this study is this: Why is all this important?

It seems important in terms of sheer economic facts affecting the United Kingdom at this time. It is essential that we understand and articulate the priorities that motivate Design practitioners. If there are mismatches in mental models it is essential that they are recognized. If we are training our Industrial Students in such a way that mismatches are perpetuated, then action should be taken.



### 1.3 The starting point

Industrial Design, in the sense that it is a matter of economic and thus political concern, has been in the air since at least the early 1960's. A measure of this has been the activity of the Design Council and the number of reports published in official and semi-official sources. Similarly there a number of "expert" articles appearing in the media. The most recent and seminal report is the Hayes Report (1983) which sounded the opinions of Manufacturers in U.K, France and Germany and highlighted some of the mismatches between what they regarded as Ideal and what they actually encountered in practice in the realm of Industrial Design. The Hayes Report provided a stimulus for the present study.

## CHAPTER 2

### THE STRUCTURE OF THE STUDY

#### 2.1 Introduction

The purpose of this chapter is to provide a guide to the argument of the study and to show the contribution of the various approaches and analyses adopted.

Chapter 1 discussed in outline reasons which prompted the study. Basic questions about the nature of Industrial Design and its importance in the modern world were posed and two sets of hypotheses were advanced :

The first set was to do with differences and potential mismatches in the way different groups - Design Students, Design Lecturers Consultant Designers, and Manufacturers - conceive of Design.

The second was to do with the actual process of Design Education - how concepts of Design progress and develop as Students go through the Design course.

Both sets of hypotheses have implications for Education and Management of Industry which, if more widely understood, might well contribute to reducing potential friction and increasing efficiency in the world of Design.

#### 2.2. Structure

The thesis begins with an historical section whose object is to set Industrial Design within its time context and to note social and economic factors and similes which might make it easier to understand the present situation.

There follows a section designed to serve as a theoretical base for the empirical study which is at the heart of the thesis. It dwells particularly on the theory which underlies the processes of concept formation and categorization and defines the terminology used.



In the light of the foregoing the experimental design is begun. Industrial Designers are interviewed and from the material obtained Surveys are formulated and data suitable for analysis is derived.

The analysis uses two main tools, Multidimensional Scalar Analysis and Loglinear Analysis to confirm and also to investigate the conceptual models of Industrial Design. Having established the content of the models and the mismatches between various groups in Industrial Design, the study suggests implications for Design training relevant both to students and to Manufacturers.

### 2.3 History of Design

The history of Design and Design Education mainly in the United Kingdom, but with references to systems in France and Germany is traced in Chapter 3. It starts in the late 18th Century going as far as 1983 with the Hayes Report commissioned by the D.E.S. and the Design Council. The chapter is concerned to point out the changing philosophic and conceptual paradigms and their associated social and economic situations. It ends with a chronology of contributory events in Art and Design.

### 2.4 Categories, Concepts and Conceptual models

The sets of hypotheses noted in 2.1 involve conceptual differences and concept formation in various groups. A key to the examination of these ideas was to be found in the work on categorization carried through in Cognitive Psychology. It was for this reason that this theoretical chapter is presented.

Categorization, within its theoretical context, is discussed, outlining various psychological viewpoints which preceded those forming the basis of the present study.

Chapter 4 discusses relations between categories and concepts and those between perception and cognition. Categorization is defined as a stimulus bound process and conceptualization as an internal process that establishes meaningful comparisons. A conceptual model is a set of concepts used in a characteristic activity - in this case, Industrial Design.

Hypotheses are advanced with regard to the development of conceptual models in an educational context and appropriate research methods used in the study are briefly introduced.

## 2.5 Pilot Survey

The preliminary stages by which information was gathered are described in Chapter 5. Informal interviews were conducted with Students, Lecturers, Designers and Manufacturers and the material from these interviews, together with material from Reports dating from 1960 formed the basis for the Pilot Survey.

Item analysis of the material resulted in ten categories or domains and questions designed to tap each of these ten were formulated. The Pilot Survey consisted of seventy questions, that is each domain was represented seven times.

Each of the 70 items was presented firstly from an IDEAL and secondly from a REAL point of view. It was considered that the IDEAL item would present an opportunity to express how matters ought to be in the field of Industrial Design, it might also provide a means whereby "acceptable" or "conformist" concepts could be discharged. In the REAL section of the Survey more trenchant and realist opinions would then be free to be expressed.

The object of the Pilot Survey was to test the parsimony and validity of the categories and to arrive at a new structure which was less a priori and presented means of mapping the data in a Survey of Design.

The method adopted was the Smallest Space Analysis (SSA) (Lingoes 1973). Details of this technique may be found at Appendix VI-1. Using this technique the ten categories were reduced to five:

Higher Order Abilities (H), Presentational Skills (P), Knowledge and Knowhow (K), Attitudes at Work (A), Values and Orientations (V).

With these in mind a Survey of Design consisting of 25 items, presented firstly from an IDEAL and then from a REAL standpoint, was constructed and formed part of a battery called the Main Survey.



## 2.6 Main Survey - Components

The experimental portion of the study was thus available and Chapter 6 describes how a Main Survey, consisting of four instruments, was administered to Industrial Design Students and Lecturers at Leicester Polytechnic, Teesside Polytechnic and the Central School of Art and Design, London.

These four instruments were:

- a. Survey of Design mentioned above
- b. Survey of Values - A value judgement measure evolved for use with Sixth formers and undergraduates
- c. Pattern Recognition Test - A truncated form of the Raven's Progressive Matrices, essentially a test of intelligence and spatial recognition.
- d. Eysenck Personality Questionnaire

The behavioural measures were included so that hypotheses about differences between Industrial Design students and other undergraduates and graduates could be tested.

The Survey of Design only was administered to Consultant Designers and to Manufacturers.

## 2.7 Analyses of Data

### 2.7.1 Survey of Design - Smallest Space Analysis

Data from the Survey of Design was subjected in Chapter 7 to a SSA (Lingoes 73) with a view to confirming or modifying the five domains posited above in 2.5. There were some variations according to Status groups but the five domains appeared as distinct.

### 2.7.2 Survey of Design - Multidimensional Scalogram Analysis

The Survey of Design was again used in Chapter 8, this time with the object of finding similarities or differences in overall responses between Status groups - Students, Lecturers, Designers, Manufacturers. The general hypothesis was that mismatches would be observed between Manufacturers and other groups. While this was not completely borne out throughout the data there were significant mismatches on many items in the Survey of Design between Commercial (Designer + Manufacturer) and Educational (Student + Lecturer).

### 2.7.3 Survey of Design - Loglinear Analyses

Chapter 9 presents data from the Survey of Design in the form of parsimonious models. These models are derived from loglinear analysis and are based on certain sets of grouped scores. Models representing Status groups, Institutions, Student Years, Class of degrees are then compared. Differences in pattern were found between Status groups, between Institutions, between "Upper" graduates and "Lower" graduates, and between Student Years. The chapter confines itself to a technical presentation and the following chapter discusses the implications in more detail.

### 2.7.4 Loglinear Analyses - Implications

Chapter 10 takes up the loglinear analyses of Chapter 9 and represents the models revealed in a visual and diagrammatic form. The implications for Design Education and for Industrial Design are discussed at greater length.

## 2.8 Behavioural Measures

Following the more limited and professional viewpoint taken in Chapters 7,8,9 and 10, Chapter 11 attempts to situate the Industrial student in his social context by using data from Behavioural measures to establish comparisons with other disciplines and occupations.

#### a. Survey of Values (SSV)

The Survey of Values (Solomons 1970) was administered to five groups of undergraduates and graduates from the following disciplines:

Industrial Design - The Central School of Art and Design, London, and the Polytechnics of Leicester and Teesside

Social Workers - Postgraduates at Leicester University

Fine Arts - Leicester Polytechnic

Business Studies - Leicester Polytechnic

Maths - Leicester University

The resulting data was analysed firstly using Analysis of Variance techniques. Subsequent trend analysis, using Newman-Keuls procedures localised the major sources of variance within each value. The value profiles produced by the respective groups are distinctive.

Data, comparative profiles for Student groups, and a sample of the SSV are found at Appendix V, together with definitions of Values.

#### b. Pattern Recognition Test. (PRT)

Norms obtained for the Industrial Design students are discussed in relation to norms for other students and for other occupational groups obtained by Raven (Raven 1962).

#### c. Eysenck Personality Questionnaire (EPQ)

Norms obtained for the Industrial Design Students are discussed in relations to those for other groups published by Eysenck (Eysenck 1975)



## 2.9 Conclusions and Discussion

The SSA analyses for the Design Survey point to a conceptual structure reasonably simple and which provides an intellectual handle whereby to hold on to what is a very complex system.

The MSA analyses, with the supporting evidence of the Frequency analyses and the Principal Components analyses point to mismatches between the Poly and the Non-Poly practitioners and hence raise the question of reconciling these mismatches. There are implications from the training standpoint and also the "education" of Manufacturers.

The Loglinear analyses provide a detailed picture of the best fitting models which adequately describe the underlying structure of the conceptual models used by Design practitioners when thinking in an IDEAL manner or a REAL manner.

Implications, drawing from the evidence of the various analyses and approaches, relating to possible modifications to the syllabus followed by students of Design, and also by students of Management. Some suggestions as to the "education" of Manufacturers are also put forward.

## CHAPTER 3

### HISTORY OF DESIGN EDUCATION

#### 3.1 Introduction

Conceptual models will be discussed from a formal standpoint in the next chapter, and it is with the models typically adopted by Design Students, Lecturers, Designers and Manufacturers that this study is mainly devoted. It is however evident that conceptual models do not arise from nothing. Industrial Design is a child of the Industrial Revolution which began in England at about the mid 18th Century, and the system of meanings which grew with the developing activity of Industrial Design is the semantic base of the conceptual models of today. The purpose of this chapter is to add a historical dimension to the Industrial Design of the present, to delineate and on occasion to detail the process leading to the contemporary situation, identifying some aspects of the successive climates of opinion.

#### 3.2 Art and Design Education

The starting point for Art Education in England may be said to be the foundation of the Royal Academy. Artists who had left the Incorporated Society of Artists presented a memorial to George III in November 1768, begging him to establish a School of Design for the use of students in the Arts. In its early years the Academy which set out to be an educational institution as the name implies, was responsible for promoting the Arts of Design, and Article IX of the Instruments of Foundation of the Royal Academy states that:

"The School of Design may be under the direction of the ablest Artists..... to examine the performance of the Students, to advise and instruct them, to endeavour to form their taste....."

Far from following the educational precepts of the Instruments of the Academy, the members actively rejected them. Professors were required to deliver six lectures per year to students in their own Schools but fewer and fewer did so, so much so that in 1808 the practice had ceased, and

the Academy seems to have become a club for painters and sculptors with an unenviable reputation so far as Art Education was concerned.

Indeed active hostility to any practical "Art of Design" was evident and members were forbidden on pain of expulsion to be members of any other society of artists pursuing practical ends. The London Architectural Society (which later became the I.B.A. and eventually the R.I.B.A.) was a case in point.

### 3.3 The Official Viewpoint

In the 1830's it was becoming clear that the lead which industry had had in the United Kingdom since the birth of the Industrial Revolution was greatly diminished. A Select Committee was appointed in 1835 to enquire into the extension of Art and Principles of Design among manufacturers and a Normal School of Design was established in 1837. Among the terms of reference of this Committee was that to:

"enquire into the best means of extending a knowledge of the Arts and Principles of Design among the people (especially the manufacturing population) of the country."

The latter did not meet much response from manufacturers since under its Head, a Mr. Papworth, it turned out to be more of the same - a mere drawing school.

Witnesses called before the Committee agreed that French manufacturers were far superior to British in Design. Typical comments include:

"I have never found a good Designer in England. In metallic manufactures the French are vastly superior to us in their designs"

Sessional Papers from 1835 Select Committee pp 22-40

So far as the Normal School of Design was concerned, the artistic appointments to its controlling Council were Academicians who had a vested interest in suppressing rivals to their Academy School. This Council later laid down that the Normal School was not:



"...for every kind of design, but for one kind only, viz ornamentation"

Sessional Papers 1843 Select Committee Normal School of Design (Minutes from 1843 Council Meeting)

The Board of Trade were conscious of the lagging performance in home Design and Industry and sent William Dyce abroad to study the Schools of Design in France and Germany.

### 3.4 Conceptual Models of the time

Conceptual models of this epoch may be characterized as follows:

- a. A traditional model which centred around aesthetics as an end in itself and paid lip service (in the appropriate circumstances) to the notion of practical applications. This may be called the Classic model.
- b. A progressive model centering around technical subjects as a viable and liberal education forming an alternative to the Classics and Fine Arts. It should be noted that the Classics model in the context of its own time, that of the Renaissance of the 15th and 16th centuries, had been an extremely practical entry to the fund of knowledge accumulated by the Latin and Grecian civilizations, but had become progressively and demonstrably lacking in practicality as the modern era advanced. This may be called the Renaissance model.
- c. A Social cum Political model which saw technical subjects as merely a useful vocational training for the lower classes. This might be termed the Pragmatic model.

This categorization parallels that put by Macdonald (1970)

"There were two distinct concepts of education in technical subjects at this time: the progressive concept of these modern subjects as important as the classics and fine Arts, and the illiberal concept of these subjects as merely useful.....for the less intelligent classes to fit them for their occupations"

William Dyce, appointed to be Master of the Trustees' Academy in Edinburgh in 1837 was a portrait painter and also a science graduate. He had convictions about Industrial Art that took their origin with the teachings of the Scottish Calvinistic Church. He envisaged a strictly ordered society in which everyone had a preordained place. He had worked in Rome with the German Nazarene school of painting and like them saw art as severe and practical craftsmanship, in effect a science.

### 3.5 The situation on the Continent

In France, Dyce found a system very much based on the Classic Model. The Academie des Beaux Arts de Lyons, for example, was in essence aesthetic in its priorities. In Germany, on the other hand, the system was much more earth bound, and was at the same time Progressive and Pragmatic.

For Dyce, therefore, the French school was antipathetic and the Germanic model of Von Fellenburg coincided well with his intellectual, emotional and religious predispositions.

Von Fellenburg's Institution, at Hofwyl, for example, provided a Lower School for the children of labourers to teach them the elements of practical training.

It was reported at the time that: "The Lower School never see a newspaper and scarcely a book.....and are taught.....a few matters of fact and rules. The rest of their education consists in inculcating habits of industry, frugality, veracity, docility etc"

Educational Review October 1819 Vol XXXII No 64 p 492

The Prussian Gewerberschulen and, par excellence, the Gewerbe Institut, provided a scientific education but had a bias towards manufacture in which art was a prime function.

The Bavarian primary classes taught simple outline drawing which also involved geometrical shapes and perspective. This was further developed in the secondary Gewerberschulen to train artisan



designers. Rigour and application were the keynotes and they were taught to design buildings and to make precision models for products. The ultimate stage for the talented students was to go to one of the three Bavarian Polytechnics to take design in technical subjects. Here, emphasis was put less on art and much more on science and production method.

The Board of Trade were greatly impressed by the reports which Dyce submitted and appointed him Superintendent of Somerset House School in 1838. He set about organizing this on the German model, that is, with the emphasis on manufacture paramount and it seems clear that this practical approach was approved by the establishment. It was however shortlived.

### 3.6 Developments in the United Kingdom

In 1843 Dyce was succeeded at Somerset House School by Charles Wilson who contributed a Classic slant to what had been a Pragmatic model. Wilson's ambition was to assemble a collection of casts and drawings of the Ancients so that by copying their proportions a sense of design might be acquired. Unfortunately, under his tutelage many advanced and talented students were obliged to undertake elementary exercises in drawing and this seemed to be the total syllabus. A sense of design may have been "acquired" but was not applied in a productive manner. Design was to be caught rather than taught and the morale of the students was not high.

In 1849 a Select Committee castigated the Schools of Design throughout the country primarily on this score. Amongst the severest of the critics was Henry Cole, a civil Servant, at that time Deputy Keeper of the Public Records.

Cole had been awarded a Silver Medal by the Society of Arts for a tea service he had designed and which Mountain's had put into full scale production. This success provided him with the credentials and the prestige for him to enter the field of Art and Design and to organize a series of British Art Manufacture Exhibitions in 1847, 1848, and 1849.

Cole had visited the Paris Exposition of 1849 and had noted the disparity in quality and design between French and English products. He approached the Prince Consort, the President of the Society of Arts, interested in Industrial design and keen "to wed mechanical skill with High Art" (Macdonald 1970 p.129) and was influential on the Committee which organized the Great Exhibition of 1851. Subsequently he was made Secretary of the Government School of Design, given control of a grant of £5000 for the purchase of exemplars of "good" design. He was also involved in the spending of the £150,000 surplus from the Great Exhibition which was devoted to the purchase of land on a South Kensington site for an Institution to promote Science and Art.

In 1852 the Department of Practical Art of the Board of Trade was created and Cole made Superintendent of Management. By 1857 he was Secretary of the Department of Science and Art and also Director of the South Kensington Museum.

From 1852 to 1873 Local Institutes for Art Education, together with Polytechnics were set up, many with strong affiliations with the Local Mechanics' Institutes. There were also Schools of Practical Art devoted to the training of teachers.

Cole hoped to:

"lead the public to feel the want of beauty and propriety.... ....to be sensible of their presence and impatient at their absence..... to demand good design in manufacture and be willing to pay for them."

Instruction in Art - Dept of Science and Art 1855

It is clear that the system was primarily to educate future consumers, to elicit demand for "good" products, to encourage industry to meet these demands. The values and the conceptual models underlying the system were pragmatic in the extreme, in Cole's own words: "especially commercial".

Following the ebb and flow of policies in the Schools of Design, the Practical Art Department of the Board of Trade provided a uniform and centralized system:



"A master must use those examples of study, and teach according to them principles that are sanctioned by the Department, which retains the entire control over the system to be followed."

Department of Practical Art - Form 132

From 1857 onwards the Department of Science and Art was popularly referred to as the "South Kensington system". The philosophy behind the system may be described as Anti Gallic and pro Teutonic, tending towards the Utilitarian and away from the Romantic.

It was a system "...of instruction.....which, though differing in many respects from the system pursued in France has yet close affinity with that of the leading Teutonic nations."

Annual Report of Birmingham Society of Arts (Minutes 1867 p.4)

The curriculum eschewed imaginative drawing and design as such. Aesthetics was not of the essence. Cole knew that the public would pay only for what it wanted, (and what it had been educated to want), and the system was geared to respond to this demand . The motive force of the approach was obviously economic and the aesthetic, educational, and personal development aspects purely adventitious.

But this conceptual model was not without critics. The backlash was powerfully expressed by such as John Ruskin who declared in 1877 that:

" insofar as the Department of Practical Art had an aim, it was a false one, insofar as it had a method, its method was wrong. Cole...had corrupted the whole system of Art teaching in this country."

And again: "The professorship of Sir Henry Cole has (led) Art teaching all over England into a state of abortion and falsehood from which it will take 20 years to recover"

Fors Clavigera Vol VII - Allen, London 1877

Ruskin was not without powerful allies, amongst whom may be cited Ebenezer Cooke, T.R.Ablett, and Walter Crane.

Cooke was an Art teacher, greatly influenced by the writings of Rousseau, Pestalozza, and Froebel with their emphasis on imagination and creativity.

For Cooke, the teacher:

"finds..... a creative being with active imagination. He accepts the fact, adapts his teaching to it, and supplies imagination"

Journal of Education Dec 1st 1885

In similar vein Ablett encouraged imaginative drawing. He founded in 1888 the Royal Drawing Society and found support from many eminent people such as Holman Hunt, Lewis Carroll, and Princess Louise, the artist daughter of Queen Victoria.

Crane was appointed Principal in 1897 of the School of Practical Art at South Kensington, now renamed the Royal College of Art. Although he only stayed for a year in this post, he initiated much, introducing lectures and demonstrations and laying the groundwork of the Central School of Arts and Crafts - the future School of Art and Design.

The reaction to the somewhat mechanical, circumscribed Cole approach was idealistic and educational. Crane found the latter "terribly mechanical and lifeless". It drew largely from the Froebel view that Art and Design were values in themselves, and that development was brought about by activities which were, such as art, valuable. It followed that art and design could be nurtured but not prescribed.

### 3.7 Changes in conceptual model

This conceptual model is evident in the official attitude expressed in a Circular issued by the new Board of Education:

" The Board regarded instruction in drawing as an important means of cultivating in children a faculty of observing, comparing all sorts of objects.....and of developing a sense of beauty."

Circular 191 HMSO 1901



The philosophical change in priorities in Art education and by extension in Design model could be loosely categorized as anti-pragmatic and pro-aesthetic. This had repercussions on the teaching of design in schools. During the Cole epoch there had been quietly evolving an embryonic examination system which had encouraged a practical approach to design.

This now came to a stop. Examination syllabi along with other official publications may be regarded as partial expressions of conceptual models. Changes in examination syllabi may equally be regarded as expressive of changes in conceptual model. An example of such an effect may be seen on the Syllabus for Art put forward by the Oxford Delegacy for Local Examinations in 1958. This included a practical test in design and was progressive in the sense that students were invited to respond to any or all of ten questions and were not limited for time. The questions covered such topics as designs for book borders, porcelain, woodcarving, glassware, ironwork, weaving etc. The syllabus was later reduced to a three question test and even this modified scheme was dropped in 1980.

Thus what had started as practical, comprehensive and specific and, as examination syllabi do, would have encouraged the teaching of such practicalities and task specifics was progressively emasculated and then extinguished.

### 3.8 The Art and Craft movement

Other inhibiting pressures on the practical model may be ascribed to the Art and Craft movement. Contemporary with the Ruskin/Cole scheme was that associated with William Morris and Walter Crane. This was characterized by an insistence on good design and craftsmanship. The irony of this was that it also insisted on individual work with traditional bias. Consequently it tended to reject anything which was of the mechanical. It could be said that in this approach there was a snobbery which consisted in deeming handicraft superior to machine product.

" Morris believed that the only way for students to produce correctly was.....through the old handicraft processes....[and] Crane himself was deficient in the main function of Industrial design, the provision of fine but cheap machine products for the people" Macdonald (1970)

Similarly Crane (1892) says:

"I hold that the true root and basis of all Art lies in the handicrafts, and that artistic impulses and invention weakens as it loses its close connection and intimate relationship with them.... Art is not Science."

### 3.9 Early 20th Century Design

The situation, even in the early decades of the 20th Century, was that British Design Education and consequently Design conceptual models were dominated or at least biased by the ideas of Crane of the R.C.A. and Morris of the Art and Craft movement. It was dominated and at the same time cocooned by the craft tradition and effectively isolated from the mainstream processes of Industrial Design, stirring on the Continent. By 1914 the initiative had been lost.

Lethaby, the first director of the Central School of Art & Design, wrote that there had been a timid reaction and a re-emergence of the catalogued styles.

"German advances have been founded on the English Arts and Crafts"  
Lethaby (1921)

The first real integration of Art and machine production stemmed in Germany following the 1914-1918 War, at the time of the Weimar republic. This unhappy period of anarchy and deliquescent values saw the gestation of modern design, although it took some time to percolate through to the United Kingdom.



### 3.10 The Weimar Bauhaus

The Weimar Bauhaus, under the direction of Walter Gropius proved to be:

"the most purposeful ever practised in Art education, planned to foster creativity, analysis and appreciation of art, craftsmanship and technology in order to produce the artists/craftsman/industrial designer". (Macdonald 1970)

The aim as expressed by Walter Gropius was:

" to educate architects, painters, sculptors at all levels.....to become competent craftsmen or independent creative artists."

Programme of the Staatliche Bauhaus, Weimar 1919

Known generally as the Weimar Bauhaus, the Institution was founded by Walter Gropius as a result of the amalgamation of the two main Schools of Art in Weimar. It moved to purpose built premises at Dessau in 1925 and remained there until 1933, successively under Hannes Meyer, and Ludwig Mies Van der Rohe, until closed down by the Nazis. At that stage most of the leading teachers sought refuge in the USA.

The Bauhaus movement was seminal in its impact. It faced up to the modern situation and forged its own traditions, its conventions, its values. It faced up to the problem of design for mass production. It perceived but chose to ignore the barrier some made between Art and Industry and between Fine Art and Applied Art.

Its influence was felt notably in the United States and Japan, but it was not until conditions similar in some respects to those which had existed in Germany after the 1914-1918 World War, and which had seen the birth of the Bauhaus movement, that its moment was come in Great Britain.

The word "moment" may be taken in two ways, one as a point in time, but also as a turning point. In Industrial Design, as in scientific

and in artistic matters, there seem to be such turning points in which the climate of ideas changes. Since the late 18th Century with the advent of the Industrial Revolution in Britain there have been swings between what may be called Classicism and what may be called Renaissance in matters of Art and Design.

By Classicism is meant a reliance on established formats and forms, originally evolved as a response to need and utility, developed to a pitch where Forms do not follow Functions, and have become not means to an end, but ends themselves - a meaningful vocabulary of Forms.

By Renaissance is meant the breakaway from established form, the breaking of the mould, usually in times of political, economic or religious flux. In these times recourse is made to function and new sets of values are forged, new paradigms are formulated.

After the 1914-1918 "Great War" and again after the 1939-1945 "World War" there were periods of social flux, when values, traditions, customs were there to be examined and re-examined, when Authority was there to be questioned and government to be changed. In short a time of Renaissance.

We may therefore view the present Design situation as typically Renascent wherein new paradigms are in process of being formed in response to new perceived needs. Older paradigms, based on former needs and former technology and typified by such dicta as "Form follows Function" are predicated on products whose function is mechanical - overtly and intrinsically visible. In this electronic age, many product functions tend to be concealed rather than obvious. "Form follows Function" no longer applies over a vast range of products and the need arises for another set of responses to Design - another set of criteria.

### 3.11 Conceptual models of Design in the mid and later 20th Century

Some recognition of the situation is to be seen in sporadic and individual initiatives before 1939. The first Art School to deviate from the traditional was the London Central School of Arts and



Crafts. Their course included stained glass work, cabinet making, textile design, building etc.

Other efforts included Birmingham which established special design classes although it must be admitted that problems were encountered with links to craft classes. At Leicester, students in what we would now term the Industrial aspect of Design had to register both with the Art School and the College of Technology.

In 1936 the Hambledon Committee argued for a reorganization of Design education and for the restoration of the original industrial priorities in the R.C.A courses. This was echoed by the Design and Industries Association.

The foregoing were symptomatic of change in percepts and ultimately in concepts.

In 1940 the Manchester School of Art set up a Bauhaus type course, but this proved somewhat abortive, since the senior Art staff seemed unsure what was being essayed. They found difficulty in linking what they knew superficially as a system of Design functional architecture to their own essentially representational and traditional Fine Art system.

### 3.12 Official Views

The initiatives above were paralleled in official Design circles. The starting point seems to be the 1930's - time of the Depression. Stirrings in the Board of Trade took their origin in this traumatic period.

Following the Gorell Report of 1931 the Council of Art and Industry was formed to deal with Art and Industry and their interaction. Regional Colleges of Art sprang up at Leicester, Birmingham, Bradford and Leeds - all in proper industrial country.

It was however after the 2nd World War that the impetus towards creative Design was articulated and nurtured in an examination frame of reference. Directly after the war in 1946 the National Diploma in Design (NDD) was born.

In 1957 the NDD was extended to a 3 years course - the necessary precursor to degree parity. This stemmed from the 2nd Report of the National Advisory Committee on Art Examination (NACtAE).

In 1959 the National Advisory Council on Art Education (NACAE) was set up and issued its 1st Report in 1960, setting up the Diploma in Art and Design ( DipAD).

The National Council for Diplomas in Art and Design was set up by the Minister of Education in 1961 as an independent self-governing body. The DipAD was the successor to the NDD, but did not satisfy the aspirations and conceptions of the Design participants.

During the years from the 1st NACAE report to the student unrest of 1968 certain fundamental changes were having their effect. The concept of the Fine Arts as elitist and confined to a relatively small number of aesthetes was changing under the influence of what may be termed "popular" art in which 20th Century man could participate. Craft techniques were becoming progressively automated and thus demanded a greater range of technical expertise and skills on the part of the designer. Design education was beginning to include new elements such as Industrial Design and General Studies. The general effect was to widen the intellectual horizon of the students and to show them that the new situation demanded new patterns of education and training.

In that climate of opinion discontent in some Colleges spilled over in the so-called "1968 Revolution" which centred on the Hornsey and the Guildford Colleges. The current situation was felt to be:

- a. "Ivory tower" in approach.
- b. Lacking in parity of esteem compared with other 3 year courses
- c. Failing to produce good Design practitioners.



The action at Hornsey and Guildford cannot be thought of as unrepresentative, although no doubt, other factors contributed at these particular Institutions. It is probable that the militant students had at least the passive support of the majority. Indeed the Movement for Rethinking Art and Design Education represented students from over 60 schools.

Students (and some Tutors) recognised that as the revolution in technology was advancing a new situation had to be faced. In Industrial Design the need for a critical analysis of teaching procedure and prestige was apparent as craft based industry was replaced by automated mass production.

The events of the late 60's focussed the situation and imparted an urgency and impetus to Design Education. The response was the joint Coldstream/Summerson Committee of 1970. This advocated, inter alia:

"courses directed specifically to certain categories of industrial and professional practice". - Structure of Art and Design Education HMSO 1970

Slightly before this response Post Diploma courses to DipAD for a further two years were established in Interior Design and Industrial Design in 1966 at Leicester, Manchester, Birmingham and the London Joint Centre of the Central School of Art and Design and the Chelsea College of Art. The stage which links directly to the situation examined in the present study occurred in 1974 when the NCDAD and the CNAA merged and the Diploma and Diploma courses led to the status of CNAA Honours degrees. More detail may be found in Appendix II on Reports and Institutions, and these inform directly the starting conceptual position of the study.

### 3.13 Chronology of contributory events in Art and Design

1768 Royal Academy of Arts founded in London.

1835 Select Committee on Arts and Manufacturers.

1837 Normal School of Design established.

1849 Select Committee on the School of Design.

1851 The Great Exhibition.

1852 Department of Practical Art of Board of Trade established under Henry Cole and Richard Redgrave.

1853 Department of Science and Art established.

1856 Department of Science and Art, together with Education Departments put under Committee of Council on Education.

1857 Central Art Training School moved to South Kensington.  
Cole appointed Secretary of Dept. of Science and Art.

1863 Central Art Training School renamed National Art Training Schools.

1896 National Art Training Schools reconstituted as Royal College of Art.

1901 RCA reorganized into four schools:  
Architecture, Painting, Sculpture, Design.  
Schools of Art followed suit.

1932 Gorell Report on productions and exhibitions of articles of good design.

1933 Board of Education's Teaching Certificate for Teachers in Schools of Art renamed Art Teachers Diploma (ATD).  
The Board recommends regional Art Colleges.  
Closure of the Bauhaus.

1934 Council of Art and Industry formed by Board of Trade.

1946 National Diplomas in Design introduced by Ministry of Education.  
Intermediate Examinations in Arts and Crafts introduced.

1957 Report of National Advisory Committee in Art Examinations.

1959 National Advisory Council on Art Education appointed.

1960 First Report of NACAE. Students of product engineering:  
"may need to acquire a substantial knowledge of engineering".  
Diploma in Art and Design instituted to replace NDD.  
National Council for Diploma in Art and Design appointed.

1962 Second Report of NACAE:  
Vocational courses in colleges and Schools of Art.

1964 Third Report of NACAE:  
Post Diploma courses in Art and Design Students in Art and Design are exceptional only in that:



- "scholarship in the generally accepted sense may not be relevant to their work".
- 1967 Royal College of Art granted University status Charter degrees of M.Art and M.Des instituted.
- 1970 Joint Report of NACAE and NCDAD:  
The Structure of Art and Design Education in the further education sector.  
Recommends industrial and professional elements in 3D Design courses.  
The study of Fine Arts regarded as:  
"not necessarily central to all studies in the Design field".
- 1972 Joint discussion between CNAA and NCDAD.
- 1972 DES Report on Employment of Art College leavers. Gives some insight into the views of employers and stresses as priorities: creativity, practical application, professionalism.
- 1974 NCDAD merged with CNAA.
- 1974 Report by Manchester Poly Institute of Advanced Studies by Nick Wayte and David Cooper. Analyses certain aspects of Art and Design curricula and puts objectives which stress task orientated and person orientated elements in the course. The curricula should encourage "insight and understanding into the applications of design, the presentation of design, self appraisal, and working as a member of a team"
- 1977 CNAA Report on BA Hons courses in Art and Design 1975-76 Notes that Industrial Design is concerned with: "materials...physical properties....study of form.....utility and costing.....the problem solving activity generally" Notes that the study of History of Art is "contentious".
- 1980 Application for renewal for MA Industrial Design CNAA. This application made by Leicester Poly , while it may be termed "establishment" in tone, stresses knowledge and practicality in the task situation.
- 1983 Hayes Report - commissioned by the Design Council and the DES Enquired into the skills, knowledge and attitudes required of the Industrial Designer by British and European manufacturers. It highlighted certain mismatches perceived by Industry, notably the balance between aesthetics and costing. The Industrial Designer, in Industry's opinion needed to get down to market reality.

### CATEGORIES, CONCEPTS AND CONCEPTUAL MODELS

"Perception and cognition are.....not just operations in the head, but transactions with the world. These transactions do not merely INform the perceiver, they also TRANSform him. Each of us is created by the cognitive acts in which he is engaged."

Neisser (1976)

#### 4.1 Introduction

This chapter is designed to provide a theoretical base for the present study. It outlines approaches made by various Schools of psychology, before discussing the notions of categorization and conceptualization, the various ways by which living organisms classify their environment and consequently the ways in which human beings structure their conceptual grasp of the real world.

It therefore presents an overview, starting with Classical Introspective Psychology, leading on to Behaviourism and Gestaltism, and discussing briefly aspects of Information Theory, computer analogies, and ideas of Artificial Intelligence before focusing on modern developments in Cognitive Psychology regarded as being germane to the present study.

Recognizing that the terms "category" and "concept" have at times been used virtually synonymously in many researches, an attempt is made to distinguish between them for the purposes of this study.

The chapter finally deals with conceptual models, their definition, actual and inferred models, IDEAL and REAL models, and feasible methods of measuring and analysing them.



## 4.2 Classical Psychology

As a separate discipline, psychology may be said to date back not much more than 100 years. Before then, psychology was regarded as an aspect of Philosophy - witness the title "Natural Philosophy", still extant in some Institutions.

Boring(1957) takes the advances made in the first half of the 19th Century in physiology and mathematics as catalytic for the new "experimental psychology". Certainly in this respect the Leipzig school is of great importance.

Fechner (1860) examined sensations on an experimental basis and presented his law that the intensity of a sensation was proportional to the logarithm of the intensity of the stimulus producing it.

Ebbinghaus (1885), studying memory proposed a "law of forgetting", relating forgetting to the logarithm of the time which had elapsed since the stimulus.

Wundt established the first "Psychological Laboratory" in Leipzig in 1879 and the first medium of publication and communication with Philosophische Studien in 1881.

These early attempts represented one aspect of psychology. They were to be taken up later with more sophistication. The relatively simple laws which were enunciated and which strove to emulate the laws of Physical Sciences were seen to apply only in extremely simplified experimental situations.

The other thrust of early psychology concentrated on so-called "mental processes" - what would be termed cognitive processes today. Analysis of these mental processes was performed by highly trained observers reporting on the activities of their own conscious minds. This involved an atypical attitude on the part of the thinker who was required not only to think but also to "observe his thinking". This specialized introspective method was beginning to fall into disrepute by the 1920's. It was considered inadequate for various reasons - not



least because of the face validity of data derived from introspection and also because of the artificial and restricted circumstances in which such introspection was carried out. A fuller discussion of the use of introspection in the study of thinking is given in Humphrey (1951).

#### 4.3 Behaviourism

Following this initial emphasis on cognition, there was a reaction which was to ignore almost completely cognitive processes. The period from the 1920's to the 1960's was largely that of Behaviourism. Between the two World Wars, Behaviourism assumed a dominating position in the U.S.A. and to some extent in Great Britain. The standpoint of the Behaviourists was to "explain" behaviour in terms of observable stimuli and responses and thus eliminate the necessity to refer to intervening or mediating cognitive states or processes.

Watson (1914), an early and influential Behaviourist adopted the position that consciousness was useless as an object of scientific study. Thinking was nothing but subvocal speech - a by-product of such "real" behaviour as the "subvocal tremor of the larynx" and as such could be safely ignored.

Subsequently such an extreme position has been toned down. Nevertheless, while the existence of mental process was admitted, later generations of Behaviourists, Hull (1952), for example, limited reference to these processes only to those occasions when they could be inferred from, or were necessary to explain, behavioural data.

Studies in the conditioning of responses as exemplified in Hull (1952), Spence (1957), Logan (1960) are seen to be applicable to simple stimulus situations. Spence, in fact, cautions that Stimulus-Response theories are models constructed for a particular ideal and controlled environment and cannot be generalized beyond the experimental situation in which they have been tested.

Various models have been put forward that occupy intermediate positions between theories elaborated within the stimulus-response

framework and those couched in terms of information processing or cognitive operations. Behaviourism leaves virtually unexplained the gap between stimulus and response and in particular how the organism deals with stimuli which have elements in common. Lawrence (1963) suggests the organism generates a unique code for each stimulus and then selects the appropriate response. These codes might be simply verbal labels or they might be images. This idea of coding leads in to that of categorization, discussed more fully in section 4.9. It was applied by Postman (1969) who uses what he calls "response selection mediating process"; By Kendler & Kendler (1968) to discrimination learning; by Martin (1971) who proposes that stimulus-response units are coded into mental processes.

" The S-R view of thinking saw it in terms of Pavlovian conditioning. Such assumptions are no longer held even by those who continue to use S-R language. The computer program has replaced conditioning as the basic paradigm." Baddeley (1974)

It seemed that the premises of Behaviourist theory that admitted as valid only S-R bonds between physically present stimuli and overt responses were inadequate in the explanation of more complex and generalisable mental processes. They did not account for any intervening mental activity nor could they admit stimuli that could be inferred but not observed, nor could they admit covert responses.

As a theoretical base for the present study, therefore, this approach to cognition and to learning does not appear to offer much profit.

#### 4.4 The Gestalt School

The focus of theory as outlined in 4.3. was anti-introspectionist and derived its inspiration from American psychology. Another perhaps less influential approach may be said to begin with Wertheimer(1923), Koffka(1935), and Kohler(1925,1935)



Gestalt theory proposed that the cortex of the brain performed as a coherent field which tended to a state of equilibrium. Incoming stimuli tended to upset this equilibrium and a new "stability of tension" had to be achieved. It was this process of achieving cortical stability that corresponded to the phenomena of organization that were termed "perceptual work" by Koffka (1935).

The original concern of the Gestalt psychologists was with perceptual organization and what they took to be its innate nature. They were also trying to analyse what is meant by "organization" at the level of the sensory cortex of the brain. This stress on organization or classification is of priority in the present study and is discussed at greater length and in more contemporary form in 4.7.

From the point of view of the present study, however, the Gestalt approach presents limitations and these lie rather in the stress on innate patterns. Not every theory of perceptual (and consequent conceptual) organization would stress innate factors to such an extent and many would seek to explain organization in terms of both innate and acquired characteristics. This latter is the point of view adopted here.

#### 4.5 The information processing approach

An important element in any discussion of cognition is that of information processing. In its initial form, information processing is associated with the practical problems involved in transmitting messages over actual physical channels such as telephone wires or radio frequencies. The notions of redundancy and uncertainty proposed by Shannon (1948) provided analogies between perceptual systems and channels conveying information.

According to these, the human operator - and "operator" conveys exactly the situation experienced in telephonic or radio transmission - may be regarded as a single channel communication system whose capacity for receiving, processing, storing and acting upon information is limited. That acquisition of a skill may be seen as a



process of organizing input data, selecting key cues, ignoring redundancies, so that it can be handled most efficiently. This is tantamount to a process of perceptual categorization with the proviso that Information Theory, concerned as it was in the first place with a limited possible single communication channel and with sensory-motor skills encounters problems when applied to other types of complex and high level skills.

In the event, therefore, these initial analogies have not proved seminal. The notion of a "bit" of information was adequate in measuring observable data processing along a channel of communication, but less than adequate in measuring perceptual data or cognitive data which acquire added dimensions of value or meaningfulness or relatedness of data.

It was in order to cope with similar criticisms that Miller (1956) rejected the definition of "bits" and substituted the more pragmatic concept of "chunks" - that is, related clumps of bits. Miller found that patterns of information, once identified as meaningful, were remembered and responded to more efficiently. The unit of information, he suggested, is the subjective unit employed by the subject in any particular context. Whereas "chunks" would seem to be still limited as explanations, yet there are affinities with the more complex concepts that are the subject matter of the present study.

Information processing, with its rigorously mathematical base, became more and more dominating in psychological circles and received a powerful impetus with the advent of the computer during the immediate post-war period.

#### 4.6 The Computer Metaphor

Associated with information processing and using many of its insights is the computer approach. It seems that a new metaphor for cognitive process emerges with the advent of the modern computer - at least the parallels are striking. The Behaviourists professed to ignore what went on between stimulus and response - in the "black box" of the mind. Yet for the computer user the computer might be

viewed as the prime example of a "black box". It accepts stimuli, performs various operations on the stimuli, and produces overt responses.

The computer, with its ability to perform complex operations unobserved, seemingly autonomous when a program is engaged, presents an attractive model for the mind and for cognitive processes. Over the last 25 years the computer metaphor for mind has been developed and has been couched in the language of computing, that is in terms of Information Processing.

Gellatly (1986) proposes some of the main similarities between computers and minds (human brains) as follows:

They may both be viewed as processors of information - that is they take inputs from various sources, transform and manipulate them and then output responses.

They achieve their diverse responses by the combination of simple functions. In computers, switches are either on or off, and this is reflected in binary code. In the brain, cells are either excited or inhibited.

They both store and use large amounts of information.

They both may be said to follow organized plans for action - programs.

However it may be said that the metaphor has some limitations from the point of view of this study. While aspects of human behaviour can and have been successfully simulated by computer, these have been where the behaviour patterns in question may be exactly and exhaustively defined.

Siegler (1986) for example has produced a computer program that simulates the way children go about performing subtraction problems. Children tend to make errors and the program builds in at random these typical mistakes. A child, for example may produce the following answers:



|       |       |
|-------|-------|
| 500   | 312   |
| - 65  | -243  |
| <hr/> | <hr/> |
| 565   | 149   |
| <hr/> | <hr/> |

Here it becomes apparent that the child believes that  $0 - n = n$ , that is if a digit is subtracted from zero the result is that digit.

Burton (1982), in Siegler (1986), found no less than 102 typical "bugs" that can adversely affect subtraction performance in children.

But the mistakes, although applied by children unsystematically, are defined by the program in advance. The computer uses efficient algorithms that guarantee identical responses to identical stimuli.

Marr (1983) postulates that the brain operates on algorithmic principles but only at simple and rather peripheral levels of sensory functioning. The way the eye/brain mechanism calculates visual depth given different clues from stereoscopic vision would seem to come into this category.

It would seem therefore from this view that the computer analogy may be valid at a relatively reflex level. As real life situations tend to transcend this simple level, so the analogy becomes progressively less valid.

Sloboda (in Gellatly et al 1986) puts the matter thus:

" From the perception of visual form through to the creation of a work of art, the human imperfection seems to confer a peculiar advantage to us ..... It is not clear that the computer approach has cracked or is going to crack every unsolved mystery. Like all metaphors, it highlights similarities and clarifies understanding, but the understanding it provides is partial."

However it may be deemed premature to make such judgements. It may well be that they cannot be absolute and reflect the limits of



computer science at the present time.

Sowa (1984) states: "Within the next two decades, techniques (of Artificial Intelligence)..... may lead to highly intelligent, useful systems. But intuition and creative insight are processes that are not understood, even in human beings".

Certainly some of the most interesting theoretical developments in the field of cognitive research have been the result of the interaction between theoretical psychology and theories of Artificial Intelligence - itself essentially computer based.

#### 4.7 Perceptual and conceptual organization

Owing at least some inspiration to the Gestalt school noted in 4.3, with its emphasis on internal mental processes one finds a change in viewpoint starting from the early 1950's with such major figures as Piaget (1950,1952,1962) and Bruner (1956).

This approach concedes the place of introspection as a source of data and a change of focus from external and observable phenomena to internal cognitive processes and the fashion in which they are acquired. In this respect a useful overview may be found in Allport (1955).

Hunt (1962), essentially a proponent of Information Theory, bears witness to this change thus:

"Perhaps the best course in the study of thought is.....(to) utilize introspective reports as heuristic guides, reserving the final test of models for situations in which they can be validated by observable responses"

Osgood (1953) defines perception as "a set of variables that intervene between sensory stimulation and awareness, with the latter state indexed by verbal or other modes of experience". Bruner (1957), moreover, makes the distinction between perception and conception. He defines the perceptual act as immediate. We feel that " a rose is a

rose is a rose" and accept it as such. This is even more evident in the perceptions of "basic" organizations, such as figure and ground. We learn to respond to complex perception without analysis of the component parts of the situation, and without necessarily forming a rule whereby to identify percepts.

According to Bruner (Bruner et al 1956) there is a need to organize our knowledge so that we may interact with our environment without being overwhelmed by its complexity.

" The world of experience is.....a tremendous array of discriminably different objects, people, events, impressions. But were we to utilize fully our capacity for registering the differences in things, ..... we should soon be overwhelmed by the complexity."

Bruner (1956) lists various benefits that accrue from organizing and categorizing our knowledge:

- a. Categorization reduces the complexity of the environment.
- b. It enables us to identify the objects of the world.
- c. It reduces the need for constant learning.
- d. With it we can decide what constitutes appropriate behaviour.
- e. It enables us to order and relate classes of objects and events.

Following Bruner investigations were made into the question of how people actually classify. These studies were mainly enquiries centering around the task of concept identification and as such tended to be laboratory experiments studying what in essence were uncomplicated situations.

Reed(1982) criticizes this approach as follows:

" Not all cognitive psychologists are satisfied with the concept identification task; some have criticized it as highly artificial and unrelated to the cognitive tasks that we usually encounter in the real world..... The predominant criticism of the concept identification paradigm is that real world categories have characteristics that differ from the categories studied in the laboratory."



It is, of course, inevitable that methods of investigations into categorization will depend on the investigator's prior concept of what a category is. Categories have tended to be treated in philosophy and linguistics, for example, as "Aristotelian" - that is as logically bounded entities definable in terms of a simple set of criteria. Many studies in the 1960's on concept or category formation have started from the premiss that categories are discrete in nature. Levine (1966) and Bourne (1968) provide reviews of such research.

An alternative approach is to view categories not as watertight or discrete, but rather as permeable and analogue structures. Rosch (1977) makes the point that such analogue structures take account of and provide parallels to the probable essentially analogue nature of many mental processes. According to this view, categorization would be neither simple nor certain but would depend on the recognition of salient and meaningful features in a potential member of a category.

Research on these lines may be found with Bransford & Franks (1971), Posner (1966,1973), Posner & Keels (1968) and Reed (1972), and these studies lead to the work by Rosch and her associates detailed in 4.10.

#### 4.8 Real world categories

There seems to be a shift of emphasis following the 1960's towards the study of cognition in medias res, that is in real world situations. This change is associated with the work of Rosch and her associates, although there is little doubt that the seeds were sown with Bruner.

The concept of "ecological validity", coined by Brunswik (1956), is familiar to present day psychologists and is a continual reminder that the artificial situation created for an experiment differs from the real world in crucial ways.



In real situations, as opposed to laboratory situations, we are in a complicated world. Stimuli assault the senses. They come not in manageable discrete doses, but in cohorts. They are perceived and categorized, not in atomistic fashion, but by reason of their relationships with others. Once a category is established then the incorporation of stimuli within that category is not automatic but depends not only on the fit between sensory input and category specification, but also on what Bruner calls the "accessibility" of the category. This is a reflection of the frequency with which examples of the category are encountered in a given context.

The idea of categorization, not as an automatic, almost reactive process, but as an activity of the mind, working on and selecting events in the real world brings us to a stage which seems of relevance in the present study.

Recent research into categorization has focused in particular on how categories are formed, how they are structured and how different categories relate the one to the other.

It is these aspects which are taken to be important in the theoretical underpinning of the present study.

It should be noted however that the terminology adopted by most researchers largely reflects the theoretical tradition of the researcher and the terms "category" and "concept" are at times used virtually synonymously. The present study distinguishes between the two usages in section 4.12.

#### 4.9 Categorization

The classification or categorization of the environment is taken by many theorists (Bergson 1911, Bruner 1957; Bourne 1966; Rosch 1978; Mervis 1980; Smith & Medin 1981; et al) to be a natural process by which an organism adapts to its environment. At a low level it enables it to reject or flee from "bad" environment or accept "good" environment. At a higher level of sentience, categorization is the

process whereby the organism "understands" and interacts with its environment and this leads to the formation of concepts. It was remarked in 4.1 that previous studies did not always differentiate between category and concept. For the purposes of this study an attempt is made so to distinguish them. Categories are taken to be concerned in initial and immediate sensory input and perceptual organization to be eventually incorporated as concepts in a more permanent fashion. Concepts in turn link and coalesce into conceptual models.

According to Rosch (1977), one of the basic functions of living organisms is to categorize its environment. This is done by classifying incoming stimuli in such a way that strictly non-identical stimuli which have related elements are treated as equivalent. This is somewhat similar to the function of the Intellect according to Bergson (1911) whereby the environment is carved up into manageable and comparable chunks.

Within philosophy it is notable that Russell (1947) puts forward a similar notion. In summarizing the ideas of Bergson (1911) he states:

" Intellect is the power of seeing things as separate one from another stream of becoming.....As intelligence was formed, outlines and paths appeared, and the primitive flux was cut up into separate bodies. The intellect may be compared to a carver, but it has the peculiarity of imagining that the chicken always was the separate pieces into which the carving knife divides it."

Mervis (1985), studying the development of categories ab initio concludes that infants spontaneously form categories to some extent even during the pre-linguistic period and postulates that these are based on the same principles used by adults for basic level categories. A child of 2 for example was taught to blow a horn and was then presented with various horn like objects. The child tried to blow these and the conclusion therefore was that he was placing them within the "horn" category.

Erlich (1983) in five separate studies with young children and what she terms their "représentations sémantiques", that is organized groups of corresponding concepts, concludes that construction of a semantic representation is facilitated by cognitive development and the process changes from a stress on empirical and contingent



relations to categorical relations. The change is from interest in temporal and causal, that is the objects or events in themselves and their immediate predecessor or successor, to interest in structure, concept coordination and the hierarchical classifications of concepts.

Zabielski (1984), using subjects aged from 2 to 17 years and studying attributes and their role in identifying concepts concludes that there is a significant interaction between the age and experience of the subjects and the number of attributes that are perceived in certain concepts.

#### 4.9.1 Types of category

In line with ideas expressed by such philosophers as Descartes (1637,1642) and emerging in modern times with the Gestalt school (see section 4.4); certain Aestheticians (Wollheim (1964,1968), Gombrich (1963), Stokes (1965), Mullins (1981); also certain Linguistic Philosophers: Chomsky (1966,1968), Lyons (1976) - consider that our perception of the external world rests upon a number of innate and intrinsic potentials.

Another line of thought exemplified by the British empiricists Locke, (1690) Hume (1740) and Berkeley (1709) would hold that our perception of the external world is simply a matter of accepting sense data and combining them in terms of what Locke would call "laws of association". This empiricist doctrine has been very influential in the development of modern psychology and is linked with the notions of physicalism and determinism with such as the Behaviourists (see section 4.3).

In the present study an eclectic approach, combining both approaches seems reasonable and it is therefore taken as a working hypothesis that perceptual categories may be of two kinds:

##### a. Categories of general or intrinsic qualities.

Species, including human beings, have become "sensitised" to certain



natural or intrinsic features of the environment. Colour, for example, unless a person is atypical and colour blind, is a "given" quality. Shape or form is similarly "out there" and it is considered by some authors that we are sensitive to certain proportions or harmonies of form. Gombrich (1978) speaks of colours or notes of music which have an intrinsic link with inner states which they are thereby able both to express and invoke. See also Wollheim (1964,1968) and Stokes (1965).

Mullins (1981) puts it thus:

"Colour itself is a kind of language. Colours can strike an emotional response in us just by what they are and by the shapes and rhythms they describe."

In dealing with these general qualities, categories are formed around perceptually salient points - presumably those that are cognate with genetic or learned necessity. These salient points, or prototypes are the centre of gravity of the category. The nature of the category may be given, but the extent and the exclusiveness is acquired from society.

#### b. Categories of relative and extrinsic qualities

Behaviour and activities which belong in a broad sense to a particular culture, but which cannot be characterized as natural or general to all men also tend to be categorized. Language, for example, whereas it would seem to be a common feature of human behaviour, differs in the particular. There are many different languages and families of languages and the content of the languages will determine the semantic categories in use by the speakers. Indeed the existence of objects in a particular culture, the fashion in which they are "used", the variety of such objects, the perceptual "sets" learnt in that culture, the cognitive paradigms extant at any given time, the richness or paucity of the language - all these must react and interact to determine the common semantic categories.

" The categories in terms of which man sorts out and responds to the world around him reflect deeply the culture into which he is born. The language, the way of life, the religion and science of a people: all of these mould the way in which a man experiences the events out of which his own history is fashioned." (Bruner 1956)

Language partakes of the intrinsic source in that - if one is to follow Chomsky (1966) - there are underlying sensitivities or potentials to linguistic behaviour patterns in the human species. Equally it is hybrid, judging from the immense variety of linguistic modes, and therefore it seems to lean towards the relative and the cultural artefact.

In this study it is argued that Design is analogous to Language, in that the activity is hybrid, involving basic aesthetic potentials, along with acquired and relative aesthetic and pragmatic attitudes that are culturally derived. These absolute and relative faculties are the components of the conceptual models of Design.

#### 4.10 Organization of Categories

In certain fields of knowledge, notably those that lay down their own rules, that are self-referential, such as Mathematics or Linguistic Philosophy, it is relatively easy to define categories, since they respond to a relatively simple set of criteria or rules.

This is not always so in the real world. In the flux of events which is the real world information is not always derived narrowly and intellectually.

To use the terminology of Bergson (1911), both "Intellect" and "Intuition" play their part. To use that of Bartlett (1932), "Schemata", effectively blueprints for mental models, which contain both intellectual and affective components and which are constructed from experience in a somewhat loose analogic manner are more common in everyday life.



Psychological principles in this analogue sense are based on the recognition that the real world is organized apart from the experience of the individual. Real world attributes are not independent of each other.

It has been argued by Rosch (1977) that categories become organized to maximize the correlation of attributes and thus their predictability.

She argues that there is generally a basic level of abstraction at which the organism can obtain the most information with the least cognitive effort. This is the most general and inclusive level at which categories are useful in delineating real world correlational structures. A related position is that the basic level is the most abstract level at which the instances of a concept have roughly the same parts.

Furthermore she postulates that there exist "nodes" of information in the sense that there occur information rich bundles of perceptual and functional attributes which form natural discontinuities. Domains become definitively structured and maintained as discrete by being coded in terms of prototypes of the most characteristic members of the category.

Eckes (1984) finds that traditional approaches to the study of cognition - those used in a limited and laboratory situation are most efficient in dealing with well-defined and artificial categories. This approach has been noted in 4.2. But natural or real world categories are not so defined and assume a continuum of category membership within which members differ in terms of typicality. Eckes proposes a structure with two dimensions, one of which would be semantic distance from a prototype and the other that of cognitive effort required to obtain a maximum of information.

Klix (1984) again proposes two dimensions in the classification, one generated from the perception of objects and the other from the perception of events. He states that the classification of objects



depends on situating them within "concatenations of memory". The emphasis along this dimension would seem to be temporal, relational and causal. The classification of events would seem to be less relational and more immediate. There are parallels with the distinction proposed by Bruner (1957) and also Bergson (1911).

#### 4.11 Natural Categories

Rosch et al (1976) note the following attributes of natural categories. In the first place, not all members are equally "good". Nor are they conveniently classifiable - they are not nicely black or white or right or left. Rather they may be composed of continuous dimensions - shades of grey or degrees of orientation. They tend also to be hierarchically organized, nested within each other. See also Mervis & Rosch (1981).

She proposes the following taxonomy of categorization:

The largest categories are termed Superordinate and would include such categories as: Musical Instrument, Fruit, Tools, Clothing, Furniture, Vehicle.

The next categories are termed Basic and would include such as: Guitar, Apple, Hammer, Trousers, Table, Car.

The smallest categories are termed Subordinate and would include such as: Classical Guitar, Cox's Orange Pippin, Tack Hammer, Football, Levi's, Occasional Table, Austin Maestro.

These levels are differentiated by the extent that members of a category share common attributes with other members but have attributes that differ from members of other categories.

In Rosch et al (1976) subjects were asked to list the attributes of objects specified at these levels and it was noted that members of a Superordinate category shared relatively few attributes, whereas the number of shared attributes increased greatly at the Basic level and then slightly at the Subordinate level.

For example Clothing was characterized as: "You wear it" and "It keeps you warm". Trousers were described as having "Legs, Two Legs, Buttons, Belt loops, Pockets, Cloth". Levi's ranked for all these descriptives plus an extra "blue".

The average number of attributes for the above categories was: Clothing 3; Trousers (Pants) 8.3; Levi's 9.7.

Although the Subordinate items share slightly more attributes than the Basic items , there is also a considerable overlap of attributes for Subordinate categories. Levi's and Underpants, for example, differ on fewer attributes than say, Trousers and Shirts, and it is therefore easier to distinguish between the latter.

Another characteristic - that of the shape of objects within a category is of importance in the classification process . The prototype of a category is usually defined as the "average" of the patterns in the category. It represents the central tendency of the category. But what does average mean in terms of shape? According to Rosch the answer to this depends on what level is taken of categorization.

Rosch (Rosch et al 1976) found that people were not very good at identifying the average shape of two different Basic level objects belonging to the same Superordinate category. For example a table and a chair. The average shape would look neither like a table nor a chair. If however objects are considered from the same Basic level - different types of chair, for example then the average shape is both more meaningful and more identifiable. According to Rosch, Subordinate categories have lower cue validity or meaningfulness than Basic categories because they share most attributes with proximate Subordinate categories. The Basic is thus the most inclusive level at which categories may represent the real world correlational structure.



#### 4.12 Categories and Concepts

It is appropriate at this stage to establish some of the relations that this study assumes to exist between category and concept. Cognitive Psychology, exemplified in the writings of such as Rosch, Mervis, Medin and others focuses on perceptual organization and categorization. This study is concerned with conceptual organization and concept formation.

According to Neisser (1976) : "Perception is the most fundamental cognitive act". Perception proper is thought to be determined by impinging stimuli whilst a mechanism of selective attention remains under the control of the individual.

Bruner (1973) takes the view that as the perceiver acquires more sophisticated perceptual skills he goes "far beyond the information given". The general effect is to make the person less "stimulus bound" and more "inner-directed". In other words the perceiver becomes the conceiver.

Discussing the nature of visual perception, Mackworth and Bruner (1970) suggest that this must develop from a state in which the gaze is controlled by the nature of the stimulus and its intrinsic features to one in which it becomes "an instrument of thought".

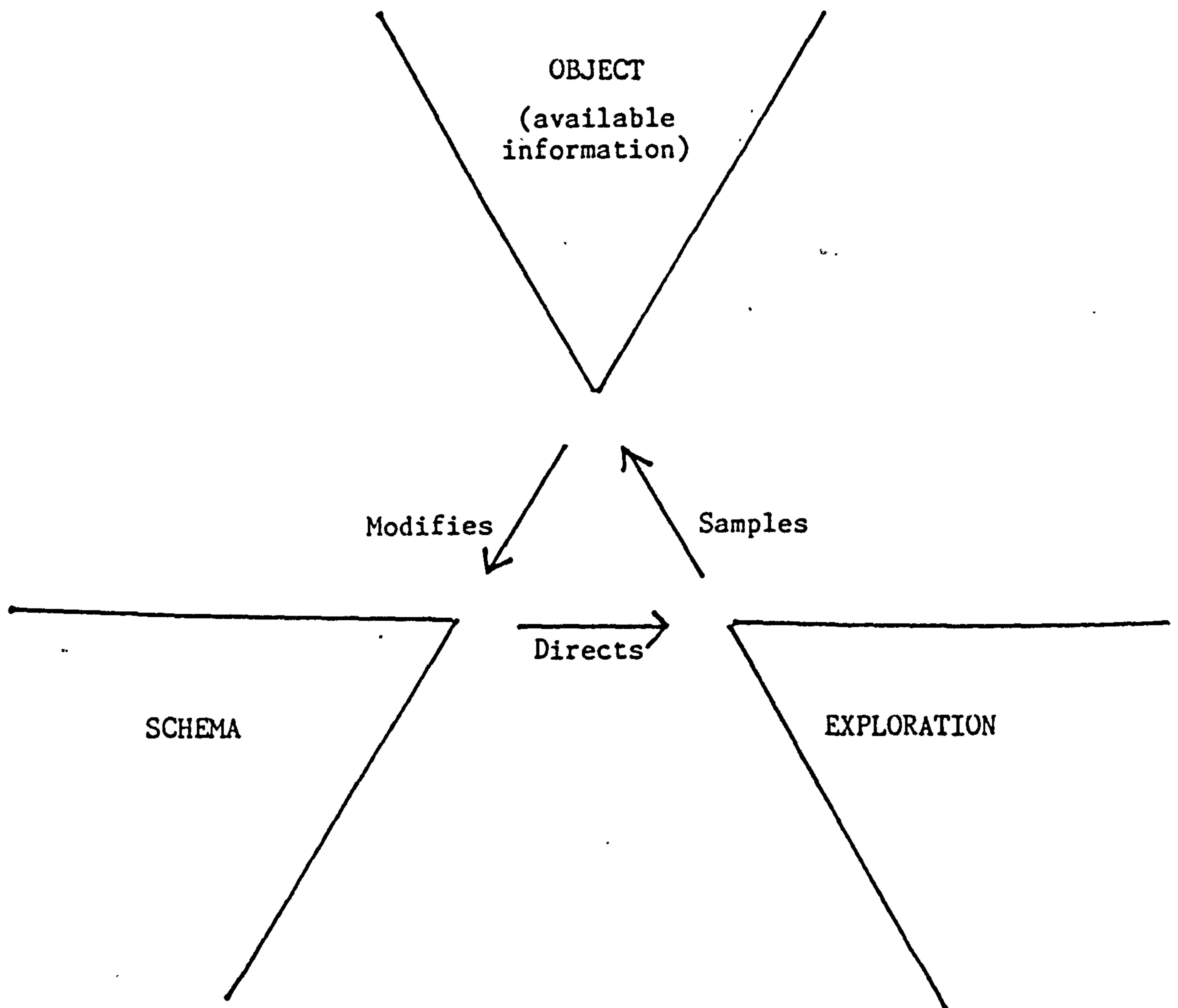
A similar view is expressed by Gibson (1976) with regard to attention which "changes from being captured to being exploratory".

Perception may be thought of as fundamental in its access to external stimuli and sense data. Categorization involves a selective perceptual process and conceptualization is a progression beyond, providing a context within which the category is embedded, over-reaching, transcending, linking, furnishing a basis of comparison with other categories and sets. From this view a concept consolidates and uses the information of perceptual categories, but in a wider setting.



DIAGRAM 1

TO SHOW THE PERCEPTUAL CYCLE PROCESS  
AS DESCRIBED BY NEISSER (1967)



However this view is neither simple nor easy. The relations between category and concept would not seem to be that of primary to secondary neither would there be any straightforward linear relationship. For one thing perception and higher mental processes seem to take place at the same time. They are simultaneous activities, some at the forefront of consciousness, some easily retrieved, some possibly difficult of access, some or all interacting.

A possible insight into this activity is provided by Neisser (1976) with his representation of the perceptual cycle.(See Diagram 1)

Neisser (1976) explains the cycle thus:

" Perception is a constructive process, but what is constructed is not a mental image appearing in consciousness.... At each moment the perceiver is constructing anticipations of certain kinds of information.....Often he must actively explore (and) the outcome of the explorations - the information picked up- modifies the original schema. Thus modified it directs further exploration."

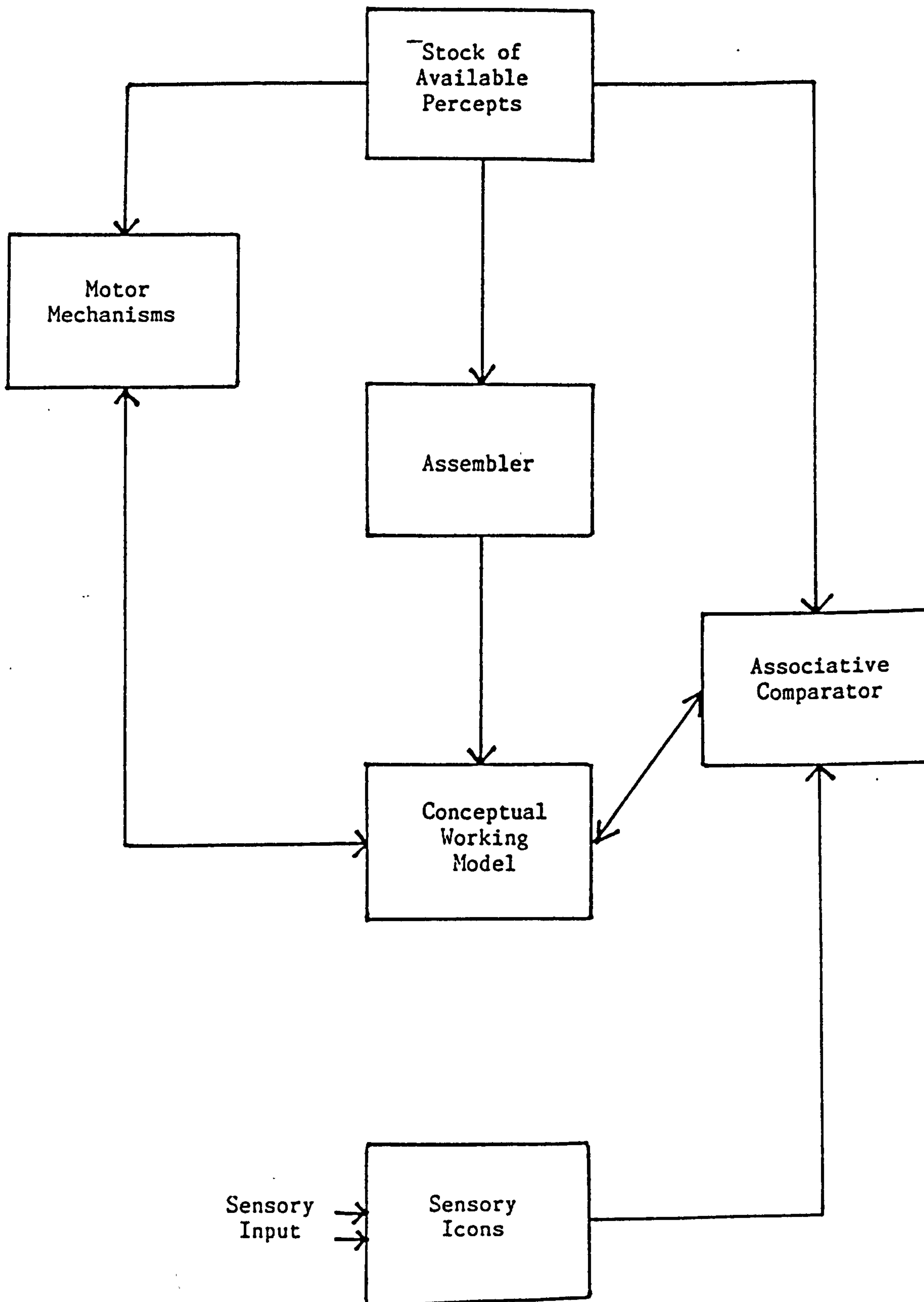
This is in line with Piaget's (1950) explanation whereby the schema develops both by assimilating the real world to the existing schema and also by adjusting the schema to fit. At a higher level, say in a complex design problem, this assimilation-accommodation becomes internalized or symbolic and schemata are co-ordinated with each other to form complex systems.

Other writers have produced similar theories whose important feature was a matching of past experience to current sensory input to form a working model. Sowa (1984) talks of a process of comparison with previous percepts and then modification of these to fit the input. It is the record of this fitting process or assembly which Sowa says is stored in a "conceptual graph". See Diagram 2.

DIAGRAM 2

TO SHOW FORMATION OF CONCEPTUAL MODEL

AS DESCRIBED BY SOWA (1984)





A plausible development of Neisser's perceptual cycle which could incorporate a schema or concept cycle is found at Diagram 3. If one bears these views in mind it may seem plausible to incorporate perception and conceptualization into one diagram. In this the perceptual cycle is central and feeds back into a concept system. The spatial metaphor here may be misleading, since Design may start from the perception of an object or from the exigencies of a brief.

#### 4.13 Definitions of concepts

Sowa (1984) defines concepts thus: "Concepts are inventions of the human mind used to construct a model of the world. They package reality into discrete units for further processing, they support powerful mechanisms for doing logic and they are indispensable for precise chains of reasoning".

In this study concepts are taken to be inner-directed and abstract categories capable of being expressed in language or image. They are assigned to categories or sets of related categories by which events or objects are classified, by which meaning is brought within manageable bounds and by which behaviour is controlled. The relevant set of concepts associated with typical behaviour or activity - say that of Industrial Design - is termed a conceptual model.

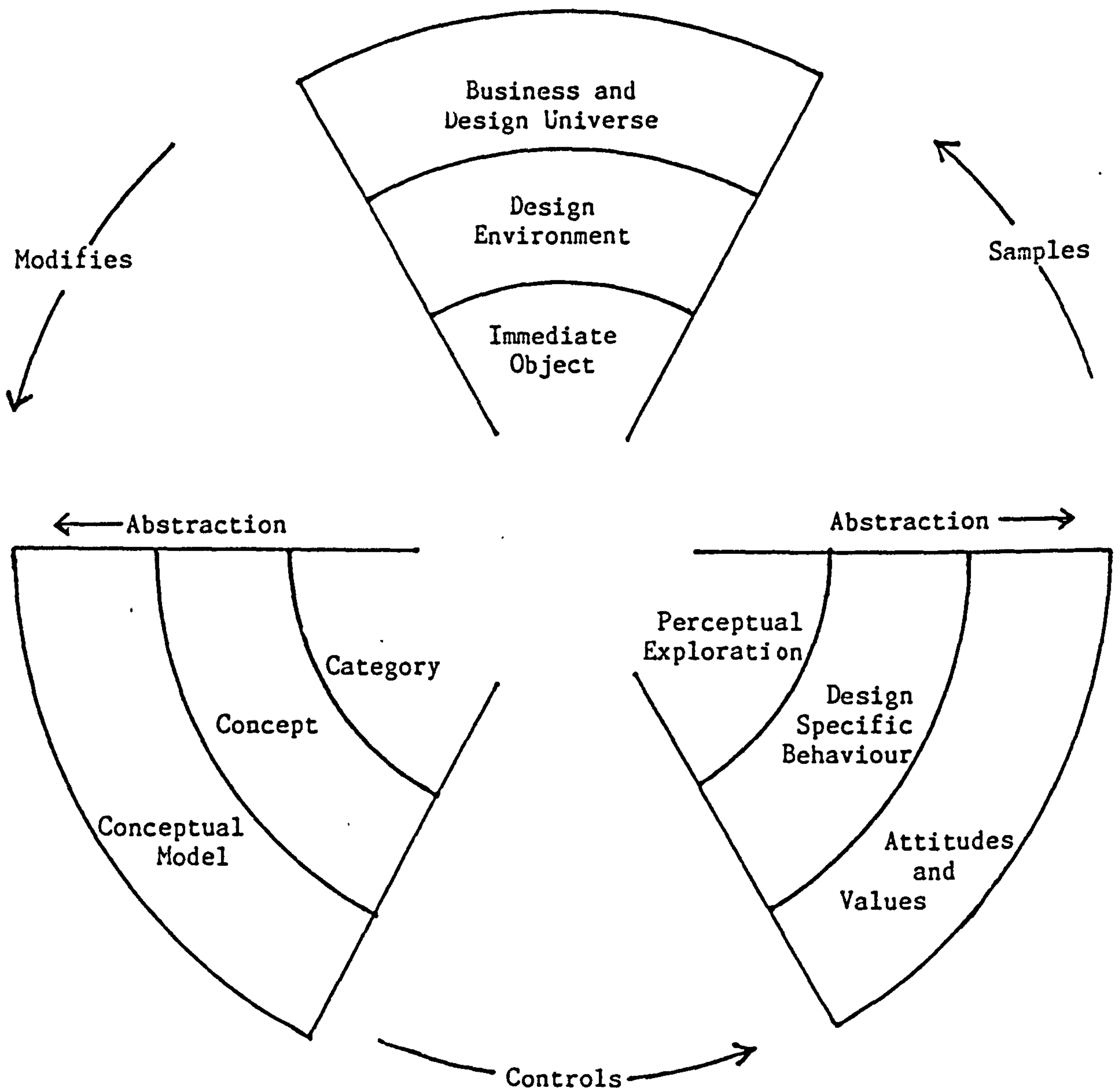
Concepts are used to categorize reality and thus simplify it and our reactions to it. It could be said that in the day routine of existence it is probably essential to have a finite ( and reasonably small) set of concepts at our disposal, and in this respect concepts resemble attitudes and even values.

As Canter et al (1984) say:

"...if we had to deal with objects, issues, behaviour, or feelings on the basis of each unique example then the effort involved would make intelligent existence virtually impossible. Thus an understanding of the categories which people use and how they assign concepts to those categories is one of the central clues to the understanding of human

DIAGRAM 3

TO SHOW THE CONCEPTUAL CYCLE  
OF DESIGN



behaviour. As a consequence, one of the many important questions for many investigations is the nature and organization of the concepts which people have, specific to the issues being explored."

Concepts tend to the cognitive, attitudes to the affective, values to the ethical classification of the real world. But all of them in some respects overlap the one with the other as strategies in interacting with reality.

But the creative design process is not just an interaction with reality but, as Gregory (1966) puts it: "a pattern of behaviour employed in inventing things of value which do not yet exist". It may start with a recognition of objective need, either by the Designer himself qua Inventor, or by a Manufacturer, couched in terms of a brief. This need is considered in the light of a number of constraints: the technical state of the art, market constraints, commercial and financial considerations. Mesarovic (1966) talks of the Industrial Designer in a dynamic relationship with his environment that contains the total spectrum of technical knowledge.

The creative design process has an input from the conceptual models, predilections, internal values and this is also set against the input from external sources. The design process may begin with a formal need or brief, but creativity involves posing the right questions, seeing beyond the facts as Bruner (1973) would put it, and then facing and resolving a series of problems.

Mesarovic (1966) speaks of a helical progression from the abstract level of the brief to the concrete level of the eventual design by way of repeated subdesigns. The task of the creative Designer is to reconcile both internal and external constraints, formulating and reformulating problems which are often ill-defined at first.



#### 4.14 Functions of concepts

In recent years there has been much work on the functions of concepts. In this respect one may note Rosch & Lloyd (1978), Mervis (1980), Mervis & Rosch (1981), Smith & Medin (1981). The following four functions, as outlined by Rey (1983) would seem to be relevant to the present study.

##### a. Simple conceptualization:

The rules by which people decide whether or not some object belongs to a class - say "Presentation Skill"

##### b. Complex classification:

The rules whereby people decide whether or not a particular object is an instance of a complex concept - say "Design".

##### c. Linguistic meaning:

That part of the meaning of a term that explains the relations of synonymy, antimony, or semantic implication. How far "boy" overlaps with "lad"; the difference between "lad" and "lass"; the associated overtones of "maleness" and "youth".

##### d. Components of cognitive states:

The intellectual explicands of beliefs, values etc.

There are some parallels that may be drawn between Rey's list of functions and those in Diagram 3. There is the same progression along a dimension of abstraction.

Firstly there is classification of actual objects perceived.

Then more complex matching processes with an existing cognitive pattern, that is, a concept.

Finally at the most abstract level, combinations of concepts - there are concept models.

Also important is Rey's insistence on the way that concepts are rules whereby decisions and behaviour are based. This is paralleled in Diagram 3. in which at all levels there is control of behaviour according to existing concepts and also modification of concepts as a result of interaction with the environment.

This control and this modification is echoed in Piaget's (1950) terminology - accommodation and assimilation.

#### 4.15 Conceptual Models - Actual and Inferred

It is therefore as working rules for the present research and as hypotheses to be investigated that the following series of statements is presented:

People's schemata, their view of the world, of themselves, of their own capabilities, of their own approved behaviour depend heavily on the conceptualizations that they bring to the task. They form internal mental models of themselves (Self Concepts) and of the events and things with which they interact. It is these internal models which are termed "User Conceptual Models" in the present study.

The User Conceptual Model (UCM) has evolved naturally. It need not be technically accurate just as the conceptual model of a work of art or literature need not necessarily follow all that the artist has felt or intended. It should however be functional and "work" for the user, or at the least be modifiable if any dissonance becomes too great.

It is constrained or mediated by the user's experience, his value system, any salient attitudes relevant to a task, and the structure of the human information processing system. These constraints will either impede or facilitate the acquisition of meaning necessary for a task, and they may be conscious or unconscious.



The conceptualization of the UCM by the outside observer must therefore be a meta model - a model of a model - striven towards by someone in an attempt to codify, predict, explain all aspects of the tasks. The UCM, however, by its very nature, is terra incognita except so far as it may be measured in Behaviouristic terms, or is related by the user as a true statement of how he felt, thought etc.

A considerable part of the specifications of the UCM are difficult if not impossible to articulate. They may be measured, if at all, indirectly. The concepts which go to make up the model are not directly observable, and like the concepts of modern theoretical physics may be deduced only in terms of the traces they leave behind, like vapour trails in a cloud chamber.

It is important therefore to distinguish between the inferred conceptual model by the outside observer - that is the meta-model (MCM), and the actual conceptual model (UCM). As researchers the temptation is to neaten the MCM as far as we understand it. Neat elegant MCM's are satisfying, but may misrepresent in crucial ways the incomplete and indistinct structure that people actually use in dealing with events.

In the present research the approach, bearing always in mind the above caveats and distinctions, is to bring to light as much as possible of the apparent and the hidden contours, associations, dynamics of the UCM. Factors which may influence the UCM, aside from those derived from the actual categorization of Design experience may be more general and of longstanding. Such factors may be related to traits of personality and attitudinal and value orientations. These are represented in the study by:

Measures of personality (Eysenck Personality Questionnaire).  
Measures of intelligence and spatial perception (Raven's Progressive Matrices). Measures of value judgement (Solomons' Study of Values 1970). These measures are discussed in more detail in Chapter 11.

Raw data provided by Surveys of Design, Value Judgement, Cognitive Ability, Personality Dimensions and individual autobiographical



details may be probed deeper to result in large scale models showing the general contours of the conceptual landscape and also more detailed models which differentiate between types of Design participants.

If, as a result of such analysis, it prove possible to articulate and express those differences it may also prove possible to reconcile them.

Neisser (1967) says that each of us is created by his own cognitive acts. The reverse may equally be true, that each of us may create his own reality.

This notion is echoed by many modern thinkers:

"We dissect nature along lines laid down by our native languages"

Whorf (1956)

"I am not saying that language creates reality. Far from it. Rather.....what counts as reality..... is a matter of the categories that we impose on the world, and these categories are for the most part linguistic."

Searle (1978)

The stress on linguistics here is perhaps to be expected, but it is part of the hypothesis of the present study that concepts have other dimensions - of emotion and value. The division of the world into distinct "things" may also be thought to depend not just on language but also on expectation and needs.

The " profit coloured" reality of the Manufacturer may be found to be distinct from the "aesthetic coloured" reality of the Design Student. But if they can be informed about the other some reconciliation may be effected, although Stamper (1973) enters some caveats against this view.

"Tout comprendre c'est tout pardonner".

#### 4.16 Ideal and Real Conceptual Models

The Hayes Report (1983) distinguished between the "Ideal" and "Real" responses made by manufacturers in the United Kingdom, France and Germany to questions of Industrial Design.

As a general observation it would appear that in many fields people tend to construct two distinct mental models. They distinguish between what ought to be the case - an ideal, normative model, and what actually is the case - a real and descriptive model.

This distinction was seen to be a valid one in the Pilot Survey in which Significant differences at the 0.001 level were revealed in all items using the Willcoxon Matched Pairs Test. IDEAL and REAL orientated questions were therefore incorporated in the Design Survey.

#### 4.17 The Development of Conceptual Models

The norms in this study are based on two models - the IDEAL and the REAL - which may be progressively modified in the face of new "facts" in any future design situation.

What is derived is the opinion of the subjects taken to be an indication of their potential behaviour in dealing with a design situation. Given this data one might be able to construct metamodels (MCM's) which represent in more or less distorted fashion underlying models (UCM's). Any differences between the two models IDEAL and REAL could prove characteristic of the way in which different practitioner Design groups take their IDEAL base and modify this in the actual encounter with the Design situation.

How these UCM's are actually formed and developed will of course depend on a variety of factors, including temperament and previous relevant experience. It has been suggested above that a search for structure is typical and that cognitive categories may be thought of as interactions between the structures that exist in the world and the state of knowledge of the perceiver.



The hypothesis would be that in the case of the debutant student (of Design) with minimal or naive knowledge this search would presumably be patchy and anecdotal. There might of course be cases with more than minimal experience - where there exists the "appropriate" family background, where Designers are part of the family circle and where matters of Design are normally discussed. In these particular cases no doubt Conceptual Models to some extent would already be formed.

But for the most part the naive student would be relatively ignorant of existing structures, while at the same time probably "hungry" for such structures. This might lead to the formation, at least temporarily of incomplete UCM's and exaggerations based on imperfectly assimilated knowledge.

There is at least some indication of this hyper-reaction to be found in First Year Students in the number of significant correlations (intercorrelations) and also in the overall variability reflected in the Principal Component analysis. These are discussed later in the study.

It may therefore be a plausible hypothesis so far as the development of Conceptual Models is concerned, that during Student Years, the process would seem to be one of acquiring "approved" knowledge and expertise and at the same time discarding "disapproved" knowledge and facts that do not fit the paradigm of the Institution in question.

It would seem that the situation from the Student viewpoint may well be one of establishing norms - the norms of the Institution in question - and the first surge of correlations that partake of enthusiasm, wishful thinking and even fantasy on the part of the naive student may be replaced by a lower level of "reality" based linkages. These in their turn, as more and external experience becomes available, would build up to the rich system characteristic of the Designer in the field which may be more idiosyncratic and contemporary than that of the Institution.

In general terms, then, concepts may differ, not only across different cultures, but also in terms of the need to accommodate



and the learned interests and needs within those subcultures.

#### 4.18 Research methods

Conceptual models are in the mind and the research essentially tried to bring them into the public domain. The theoretical bases of this study parallel those proposed by such Cognitive Psychologists as Rosch and Rey, referred to above. The concepts and conceptual models posited take their place in the theoretical framework proposed by Rosch and discussed in 4.11 and are equivalent in her taxonomy to "basic" and "superordinate" categories. The individual events and objects encountered by the Designer equate to her "subordinate" category. This categorical framework is utilized in the experimental design in which the items of the Survey of Design, discussed in 6.1, lie at the base of the categorical hierarchy. The task of the empirical study is to elicit the ways in which these individual items are grouped into concepts and these concepts associated in conceptual models. Parallel is the taxonomy proposed by Rey and discussed in 4.14 whereby concept would equate to his "simple conceptualization" and conceptual model to his "complex classification".

A further distinction posited in this study was between that of the User Conceptual Model (UCM) and the Meta Conceptual Model (MCM). The latter was the meta-model, derived from the views of Student, Lecturer, Designer, Manufacturer. The MCM therefore is the public representation of the trends and patterns of the UCM. What was to be guarded against was the maiming and distortion of the original expression of the UCM's - systems of subjective and personal meaning.

An appropriate method of investigation, and one followed by researchers in similar fields was to carry out a two stage enquiry: Stage 1 consisted entirely in collecting a wide range of Design information by means of unstructured interviews. Stage 2 was that of inspecting and analysing this information to see what inherent structure was contained.

This was why stress was placed on the essentially unstructured nature of the initial interviewing and collection of concept material, and why extremely tentative hypotheses were framed about

the characteristics of the conceptual models which were eventually to be examined.

The routine repetitious application of standard univariate statistical tests is not appropriate for this type of data. In dealing with complex multivariate data the objective in this study is to summarize in such a way as still to allow the investigation of individual cases and also to assess the variability between individuals.

Two basic approaches were used:

- a. Multidimensional Scaling (MDS).
- b. Loglinear Analysis (LL)

#### 4.18.1 Multidimensional Scaling

With MDS verbal reports of experience may be collated and interpreted to reveal underlying conceptual patterns. Degrees of similarities among items and responses are graphically represented on an array or plot. The closer the plots are spatially the closer they are conceptually.

MDS therefore acts as a classificatory device and is a systematic way of handling and interpreting complex verbal data. It is a strategy for grasping (gently) essentially phenomenological and personal meanings and presenting them in patterns.

Various forms of MDS exist and in this research Smallest Space Analysis (SSA1) and Multidimensional Scalogram Analysis (MSA1), both in the Gutmann Lingoes (Lingoes 1973) series were used.

A more detailed account of Smallest Scale Analysis may be found at Chapter 7, of Multidimensional Scalogram Analysis at Chapter 8, together with further discussion in the Appendix VI-1 on Statistical Method.



#### 4.18.2 Loglinear Modelling

Whereas MDS deals with the complete gamut of variables it only determines that certain structures exist, that there are certain conceptual domains which can be demonstrated. LL focuses more clearly on the details and can determine the strength of associations between a small number of variables. In effect they are a kind of super Chi square test with the bonus that they can describe the detail of interactions between the variables. To these interactions they can provide a numerical indication of their relative strength, and this is parallel to the significance obtained in ANOVA.

Further detailed discussion of the results both of MDS and of Loglinear Analysis may be found in Chapters 7, 8, 9, and 10.

#### 4.19 Summary

The chapter presents categorization within its theoretical context, outlining various viewpoints which preceded those which form the basis of the present study.

It goes on to discuss the relations between categories and concepts and between perception and cognition. Categorization is defined as a stimulus bound perceptual process and conceptualization as an internal process which establishes meaningful comparisons. A conceptual model is a set of concepts used in a characteristic activity - say Industrial Design.

Hypotheses are put forward with regard to the development of Conceptual Models in Students of Design.

Research methods to be used in the study are briefly introduced together with the rationale for them.



## CHAPTER 5

### THE PILOT SURVEY

#### 5.1 Sources and Content analysis

This initial phase of the study involved the gathering of responses and their analysis in such a way that their essence could be used and expressed in a main Survey of Design. At the same time the dangers implicit in such a procedure - that of prejudging or slanting the interpretation to placate the observer's pre-conceptions were very much in mind.

Two sources were tapped - one more formal and public than the other:

a. The "live" contributions of practitioners of Design, as revealed in interviews.

b. Reports by various bodies and Institutions. These are important statements of contemporary climates of design opinion. They represent public aspirations and ideals which tend to be somewhat behind actuality. But they are important in influencing, channelling, possibly constraining the syllabi offered to Lecturers and Students. They are points of reference and provide evidence of the official viewpoint.

Chapter 3 cited these official reports and put them in their historical context. A more detailed exposition of their content follows later in this chapter.

The object of this research study was to identify and to examine what the activity categorized as "Industrial Design" meant to those who were studying it, teaching it, indulging in it or making use of it in an industrial setting.

"Industrial Design" was taken to mean Design as applied to products of any kind which were to be made in large numbers or series. The first task was to acquire some "facts" and by this was meant conceptual information. Even at this stage it was recognized that these "facts" by their very nature could only be obtained from the

Design population, that they were essentially partial in nature and subjective in content. They represented the material for categorisation at the Roschian "subordinate" level, to be grouped in the "basic" and subsequently the "superordinate" categories. The latter two are termed concepts and conceptual models in the present study.

The conceptual models locked in the minds of the Design populations could not in themselves prove accessible to outsiders, perhaps not completely accessible to the individual himself, since they were intimately bound up with personal experience. Yet it was proposed to interview typical members of the Design population on the assumption that what portions of conceptual models were inhibited in individuals might show up when many individuals cooperated. It was also felt that the researcher who was an outsider so far as Design was concerned could identify such trends with that much less ulterior motive.

## 5.2 Interviews

Interviews were conducted with Students of Industrial Design at Leicester Polytechnic, Lecturers of Industrial Design, Consultant Designers at Leicester, Manufacturers of Product Design in the East and West Midlands. The interviews were loosely structured, except for the fact that they started with a rapid explanation of the purpose of the research.

After that various question leads were proffered: As a Student of Design, Lecturer, Designer... ..... what kind of things do you think go towards good Design? To what extent does artistic competence come into it? How practical a person is the Designer? What limitations does a Designer meet? Do you think your ideas coincide with.....? What is a good Design Student? What priorities are there in Industrial Design as between: Aesthetic, practical, marketing, manufacturing skills and knowledge?

The above is not exhaustive and indeed the interview was very much played by ear, since what was sought was the unsolicited. It must be said that to some extent the interviews were guided, but they quickly transcended any structure that may have been proffered and as far as may be judged developed into a free expression of opinion about the state of Industrial Design.



While it was stated at the outset that the interview might last ten minutes, the duration was normally at least thirty and this was taken to be a measure of the willingness to talk and the validity of the ideas expressed.

It was felt that note taking would interfere with the free flow of conversation and so all interviews were taped, with the consent of the interviewee. These tapes were then transcribed, usually in a somewhat elliptical form, since the originals tended to be rather redundant in content. The protocols are therefore more in the nature of precis but preserving verbatim what were seen to be significant utterances that bore upon the topic of Industrial Design. Examples of such protocols may be found at Appendix I.

### 5.3 Analysis of Protocol Material

The task at this stage was to reduce a great deal of material to manageable and comprehensible proportions. To this end the material was arranged in categories which seemed to occur naturally. From these categories a Pilot Survey was formulated so that a more rigorous examination and analysis could be begun. This Survey embodied a great many verbatim portions of the interview protocols. Here follow a selection of extracts from interviews arranged in categories and with the source noted. A larger sample is to be found at Appendix I.

#### 5.3.1 Aesthetic/Creative flow of ideas

Aesthetics is not so important as creativity (Student 1st Year).

Combines technology with sensitivity (Lecturer).

An applied artist (Consultant Designer).

I work from the nice looking (Student 3rd Year).

The Industrial Designer is a fertile but not necessarily prettified source of ideas (Lecturer).

The consumer is swayed by aesthetics (Consultant Designer).



### 5.3.2 Processes/manufacturing/technical knowhow

The Industrial Designer understands industrial process (Lecturer).

The Industrial Designer is a mixture of technician and artist (Consultant Designer).

He has to know about how the product is manufactured (Consultant)

He should know a bit about everything (Student 2nd Year)

As soon as you know too much you lose your flair (Student 2nd Year)

Technology comes first (Student 3rd Year)

There is an affinity between function and styling (Lecturer).

### 5.3.3 Commercial and interpersonal skills

He must have enough knowledge to relate to others (Student 2nd Year)

The Industrial Designer must be able to put ideas across (Student 1st Year)

Industrial Design values are more commercial than social (Lecturer).

There is an emphasis on presentation (Student 3rd Year)

The Industrial Designer is able to synthesize from the different ideas that specialists have (Lecturer).

The Industrial Designer is able to organize extreme views (Consultant Designer).

### 5.3.4 Marketing and the consumer

The Industrial Designer must design in the context of the time (Lecturer).

He is a socially responsible person (Student 2nd Year)

There is a lot of marketing in the make up of the Industrial Designer (Student 3rd Year)

The Industrial Designer would like to see a better world (Student 3rd Year)

He is entrepreneurial and at the same time aesthetic (Lecturer).

He must understand the consumer end (Lecturer).

#### 5.3.5 Personality and Insight

The Industrial Designer has a clear perception of himself and of others (Lecturer).

Above all he is adaptable (Consultant Designer).

You must sell yourself (Student 2nd Year)

Students feel on a higher plane - they will learn. (Consultant Designer)

If you are mean and selfish your Design will be mean and selfish (Student 3rd Year)

There must be a mental agility and a breadth of knowledge (Lecturer)

#### 5.3.6 Changes in perception by the Industrial Designer

There was no difference over the course but subsequently a great deal (Consultant Designer).

There is a lot more to it than I thought (Student 1st Year)

My ideas have become more refined (Student 2nd Year)

My ideas have totally changed (Student 2nd Year)

You may have to unlearn things you have learnt on the course  
(Student 3rd Year)

You don't know anything till you get out (Student 1st Year)

#### 5.4 Analysis of material from Reports and Institutions

To add to the material derived from Interviews certain Reports commissioned by the DES, the Design Council, the CNAA and Polytechnics were examined. This represents what might be called the Establishment Model and was also borne in mind when the Pilot Survey was constructed.

Here follow various ideas from these Reports. A fuller set of precis and comments are to be found in Appendix II.

##### 5.4.1 National Advisory Council on Art Education - 1st Report 1960

Notes that students of Product Design "may need to acquire a substantial knowledge of engineering".

##### 5.4.2 NACAE 3rd Report 1964

Notes that students of Art and Design are exceptional only in that "scholarship in the generally accepted sense may not be relevant to their work".

##### 5.4.3 NACAE Structure of Art and Design Education 1970

Comes down in favour of sandwich courses insofar as 3D Design, that is including within the course a period of industrial or professional experience. Concludes that the majority of students completing such courses will be ready to proceed directly to employment.

The study of Fine Arts is regarded (euphemistically) as "not necessarily central to all studies in the Design field"



#### 5.4.4 CNAA Report on BA Hons courses in Art and Design 1975-6

Notes that Industrial Design is concerned with : "materials.. physical properties.....study of form.....utility and costing.....the problem solving activity generally".

There is some concern that techniques are stressed at the expense of aesthetic standards and admits that the regulations governing the History of Art are being increasingly questioned by some staff teaching "Main Studies" and states that it is "contentious".

#### 5.4.5 DES Report on the Employment of Art College Leavers 1972

This gives some insight into the views of Employers. It gives a shopping list of those qualities looked for by employers. The effect is overwhelming and the list may say more about Employers rather than Designers.

#### 5.4.6 Manchester Polytechnic Inst of Advanced Studies 1974

This Report by Nick Wayte and David Cooper analyses certain aspects of Art and Design curricula. The recommendations and objectives suggested therein are interesting in that the ideal conceptual model may be inferred from them.

#### 5.4.7 Design Council - The Design Requirements of Industry 1983

The Hayes Report was commissioned by the DES and the Design Council and carried out by Chris Hayes and Keller Horsey Associates.

It enquired into the skills, knowledge and attitudes which industry (British and European) requires from the Industrial Designer.

In particular industry was concerned with lack of skill in assessing the financial implications of the design. It was felt that the balance was wrong between costing and aesthetics. The Industrial Designer opted for aesthetics and it was thought by

industry that Design education should prepare better for the realities of the market.

#### 5.4.8 Application for renewal for MA Industrial Design CNAA 1980

This application for a degree approval submitted by Leicester Polytechnic reveals what may be termed the overt ostensible and establishment conceptual model of Industrial Design.

### 5.5 The evolution of the Pilot Survey

What seems to emerge from the initial stages of content analysis is complex . If the research were to proceed the mass of material needed to be digested and simplified and objectified.

The essential categories could be expressed as follows:

The "Ideal Industrial Designer" :

- Has sensitivity and aesthetic discrimination.
- Has practical intelligence in problem solving.
- Thinks laterally.
- Is able to extract information relevant in a brief.
- Has adequate skills to understand processes.
- Communicates in visual terms.
- Communicates in verbal terms.
- Synthesises ideas from a variety of specialists.
- Relates well to others in a commercial setting.
- Is sensitive to consumer needs and reactions.
- Is aware of constraints - aesthetic, material and commercial.

This list of paragon qualities embodies, as it were, the highest common factors supplied by a variety of Design people. It was apparent that there existed some degree of consensus about the salient aspects of Industrial Design, although it was not clear what observations had been made with an ideal in mind and what statements were targeted on the actual state of Industrial Design as encountered or thought to be encountered in practice.



With this in mind the Pilot Survey concerned itself not only with Industrial Design as a Platonic Form but also in the Real World. As a starting point it was assumed from the trends shown in Interviews, Reports etc. that a conceptual model largely acceptable to the Design populations could be subsumed under ten categories. The Pilot Survey therefore used a model with the following categories:

Aesthetic, Creative, Visual, Verbal, Industrial, Business, Marketing, Social, Financial, and Interpersonal.

Each category was represented by seven statements presented from an IDEAL and then from a REAL standpoint. The Pilot Survey therefore consisted of 140 items.

This Pilot Survey was administered to the Students and the Lecturers of two Polytechnics - Teesside and West Glamorgan Institute of Higher Education - 6 lecturers and 66 students. The Survey was introduced by stating that it was designed to investigate how Design protagonists understood Industrial Design. Respondents were asked to express their agreement (or lack of it) with statements about the Designer and his behaviour along a scale 6 to 1 for an IDEAL or REAL situation.

The full Pilot Survey may be found at Appendix III, but for the convenience of the reader the items are included here. The first 6 responses are confined to Background enquiries and the numbering therefore starts at 7:

7. The flow of ideas is the single most important quality
8. The Industrial Designer is essentially an entrepreneur
9. The Industrial Designer has detailed insight into the relevant manufacturing methods
10. The Industrial Designer is a person of considerable acumen and drive
11. The Industrial Designer is not too aware of production constraints, and in fact these might inhibit a fresh approach
12. Above all the product has to look right
13. The Industrial Designer is able to transform a client's brief into a set of visual ideas
14. The Industrial Designer is basically there to present the product
15. The Industrial Designer has experience in production and is competent to suggest relevant techniques
16. The Industrial Designer is never in a rut - thinks laterally



17. The Industrial Designer thinks in human terms and is concerned for the user
18. The Industrial Designer is attuned to the consumer and knows how the product will slot into the market
19. For the Industrial Designer the money motif is the main one behind all design decisions
20. The Industrial Designer starts by putting the problem before all people involved simultaneously
21. The Industrial Designer has a vast fund of Design ideas
22. The Industrial Designer is experienced in business and can discuss accounting, costing and sales methods
23. For the Industrial Designer cost is not important, the best will sell
24. The Industrial Designer is happiest in the Design Office, a little wary
25. The Industrial Designer is not a backroom boy but is out and about and in tune with the modern world
26. The Industrial Designer is alert to safety requirements and their implications
27. The Industrial Designer is a stylist to provide an acceptable face to engineering
28. For the Industrial Designer personality and client-side manner are important
29. Like the consumer, the Industrial Designer is very much swayed by aesthetics
30. Art is all very well, but the Industrial Designer must first understand the technology
31. The Industrial Designer is a person of extreme aesthetic sensitivity and discrimination
32. The Industrial Designer talks intelligently and enthusiastically about the product
33. For the Industrial Designer the logic of the product is a visual logic
34. For the Industrial Designer profit is a major motive
35. The Industrial Designer understands the product in its total commercial context
36. The visual is a strong point in the Industrial Designer
37. For the Industrial Designer the essential ingredients are creativity and imagination
38. The Industrial Designer presents his ideas well and persuasively

39. The Industrial Designer considers it naive to bring in ideas of social responsibility - he simply has a brief to fulfil
40. The Industrial Designer considers what society really needs and designs accordingly
41. The Industrial Designer organises extreme views to effect the right decision
42. The Industrial Designer coordinates the Design effort and knows enough to ask the right questions for the success of the enterprise
43. The Industrial Designer produces a whole series of drawings to trigger the imagination
44. The Industrial Designer has a talent for presenting well drawn design concepts
45. The Industrial Designer is relatively poor at expressing ideas in writing
46. The Industrial Designer should have some idea of the investment required if new methods are to be introduced
47. The Industrial Designer is good in committee and understands how to make points
48. For the Industrial Designer business matters waste time and energy best devoted to Design
49. The Industrial Designer would like to contribute in his designs towards a better world
50. For the Industrial Designer marketing is ultimately more potent than design
51. The Industrial Designer is flexible and well able to put up alternative proposals products
52. The Industrial Designer knows exactly the characteristics and limits of materials the product
53. The Industrial Designer is able to design down to a price
54. The Industrial Designer is intuitive towards others and himself
55. The Industrial Designer knows enough to ask the right people the right questions at right time
56. The Industrial Designer is aware of and relishes fashion
57. The Industrial Designer is articulate with a gift for presenting ideas and gaining support from management
58. The Industrial Designer comes up with ideas, but these are handed over to the Engineer to tool up
59. The Industrial Designer works to dead lines and is meticulous
60. The Industrial Designer is a boffin, not a whizz kid
61. The Industrial Designer has an ear to the ground and is aware of



- present market prospects
62. The Industrial Designer is knowledgeable in computing, especially Computer Assisted Design
  63. The Industrial Designer raises the quality of product appearance and packaging
  64. For the Industrial Designer aesthetics is unimportant except in its marketing implications
  65. The Industrial Designer has values that are more social than commercial
  66. In Industrial Designer the drawing's not up to much but it conveys the ideas well
  67. The Industrial Designer is skilled in the appropriate market skills - Psychology, Display, Advertising
  68. The Industrial Designer is one amongst equal with accountants, marketing, engineers so on
  69. The Industrial Designer is responsible for producing a universally elegant and acceptable product
  70. Given design talent, the real task of the Industrial Designer is to face up to commercial, costing, and legal situations
  71. The Industrial Designer comes up with ideas, some of them possibly impractical but unconstrained
  72. The Industrial Designer has a conscience at designing products which may prove anti-social
  73. The Industrial Designer's task is to create images and to educate the public in what it will need
  74. For the Industrial Designer cost comes way behind in the list of priorities
  75. The Industrial Designer is first and foremost a communicator
  76. The Industrial Designer is outgoing, good with people, able to socialise freely.

#### 5.5.1 Distribution of categories among the Questions

The ten categories mentioned above were distributed at random among the seventy items as follows:

Aesthetic 14 27 29 31 63 64 69  
 Creative 7,16,21,37,51,60,71  
 Visual 12 13 33 36 43 44 66  
 Verbal 20 32 38 45 47 57 75



Industrial 9 11 15 30 52 55 58  
Business 10 22 35 48 59 62 70  
Marketing 18 25 50 56 61 67 73  
Social 17 26 39 40 49 65 72  
Financial 8 19 23 34 46 53 74  
Interpersonal 24 28 41 42 54 68 76

### 5.6 Discussion of Pilot Survey results

Responses were received from 72 students and staff at Teesside and Glamorgan Polytechnics.

It was soon evident that the initial ten categories posited were not necessarily independent nor were they parsimonious. Correlation analysis showed low correlations between items in the "same" category, and therefore ostensibly related.

On the other hand the differentiation between IDEAL and REAL modes was significant as measured by a Wilcoxon Matched Pairs analysis. Out of 70 matched pairs IDEAL/REAL significant differences ( $p < 0.001$ ) were shown for 65.

The low correlations could be explained from the "muddy" nature of the items. They had been derived directly from protocol material and were complex - in the context of a Survey obviously too complex. In normal interpersonal transactions complexity is typical but it is normally "helped out" by other devices: tautology and redundancy, intonation and other physiological cues.

The items contained more than one concept and were responded to according to the salience perceived by various respondents. They also contained words which were viewed in an unexpectedly pejorative way:

"Artistic" (14), "stylist" (27), "acumen" (10), "marketing" (50) were wrong from this viewpoint. "The single most important quality" (7) was felt to be too dogmatic. The concepts of "cost" and "best" in (23) were not irreconcilable (41) was felt to be question begging and imputed a political, not to say Machiavellian role to the Industrial Designer. (43) spanned two categories - Visual and Creative. (45) gave altogether too much scope with

"relatively" (48) posed a possible (false?) dichotomy between Business and Design. (72) was felt to be too rare and hypothetical (75) was felt to be too exclusive, pre-empting other categories and thus difficult to assent or dissent.

Certain questions were phrased in a negative manner to see how people would react against them. They were scored accordingly. They seem however to have presented problems of understanding and this format was abandoned in the Main Survey.

It was scarcely to be expected that a Pilot Survey would not have shortcomings. The thrust and the *raison d'etre* of this one was to establish fruitful lines of further investigation and to identify reasonable and economic ways of categorizing Industrial Design concepts.

The statistical method adopted to perform this latter task was based on the Multidimensional Scalogram technique using the Guttman Lingoes series. This uses in what is called a Smallest Space Analysis intercorrelations to show graphically how variables group together and pattern. Even if the data prove "muddy" it might prove possible to discern groupings which were at the same time systematic and less preconceived and therefore usable in the next stage of research. Chapter 7 and Appendix VI-1 give further details of the technique.

At this stage the research was operating at the theoretical limits prescribed for Smallest Space Analysis. The number of cases (respondents) should considerably outnumber the number of variables (items) being used. In fact there were 72 respondents and 70 items for IDEAL and 70 for REAL.

Nevertheless an SSA1 was performed and computer plots for IDEAL and REAL, together with schematic diagrams are to be found at Diagrams 4, 5, 6 and 7 overleaf.

The Item Diagrams for SSA reveal certain domains but they are by no means exclusive or clear. This is doubtless because of some of the flaws in the items cited above. The linguistic and conceptual ambiguities were not improved as the subject tried to communicate what he could honestly articulate of his UCM ( see Chapter 3) into the public field.



DIAGRAM 4

COMPUTER PLOT SSA 1  
PILOT SURVEY OF DESIGN - IDEAL

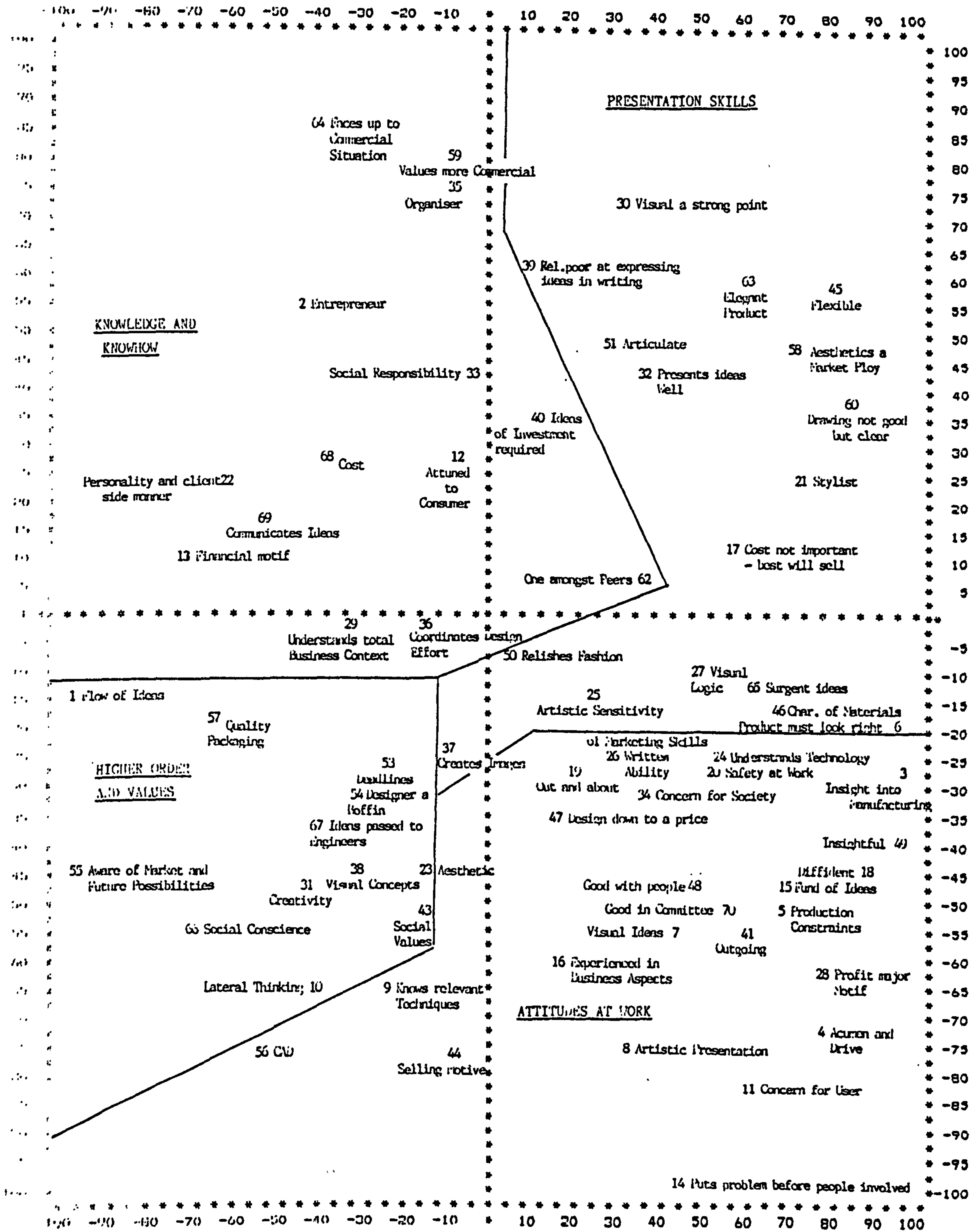
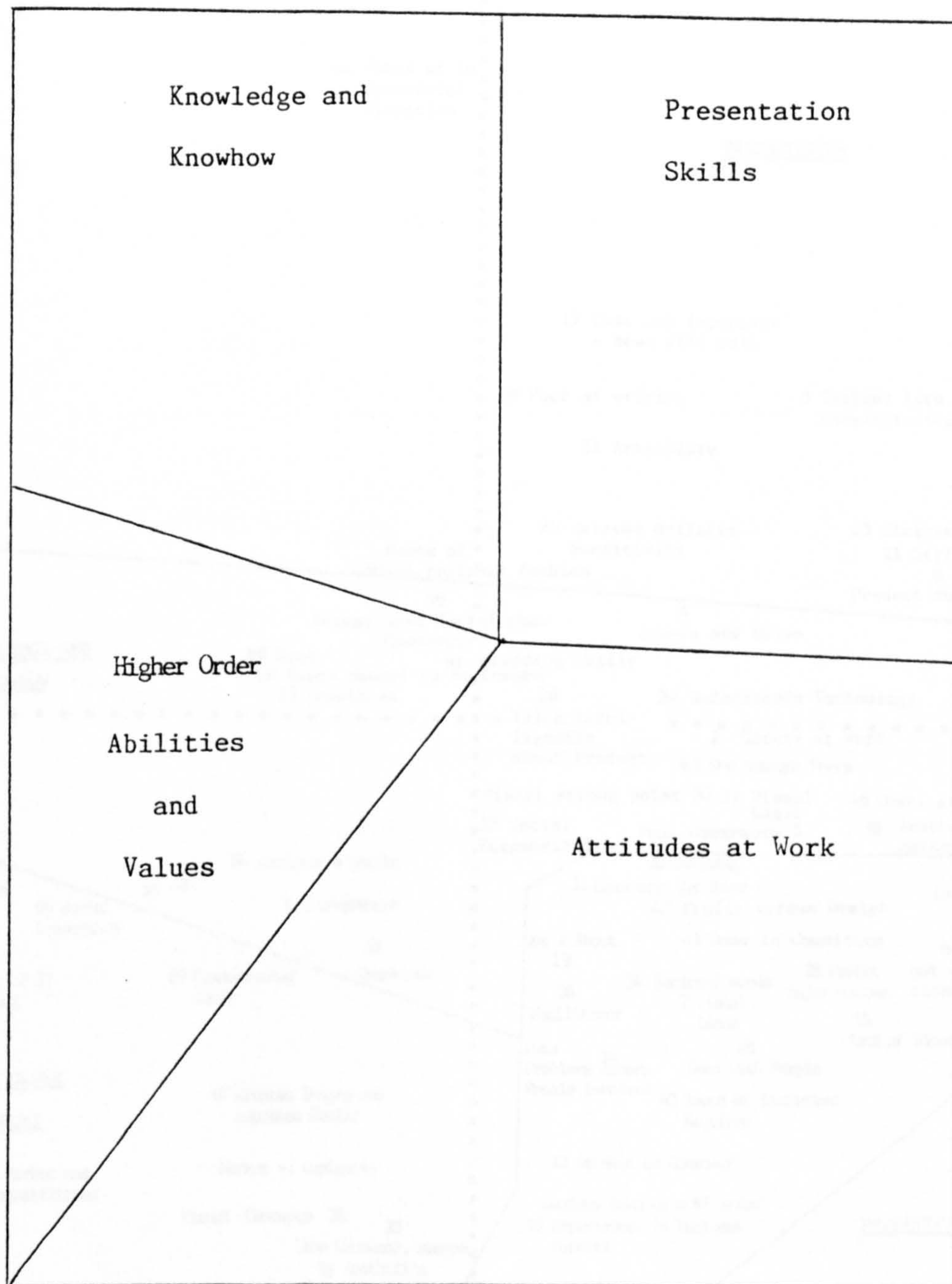




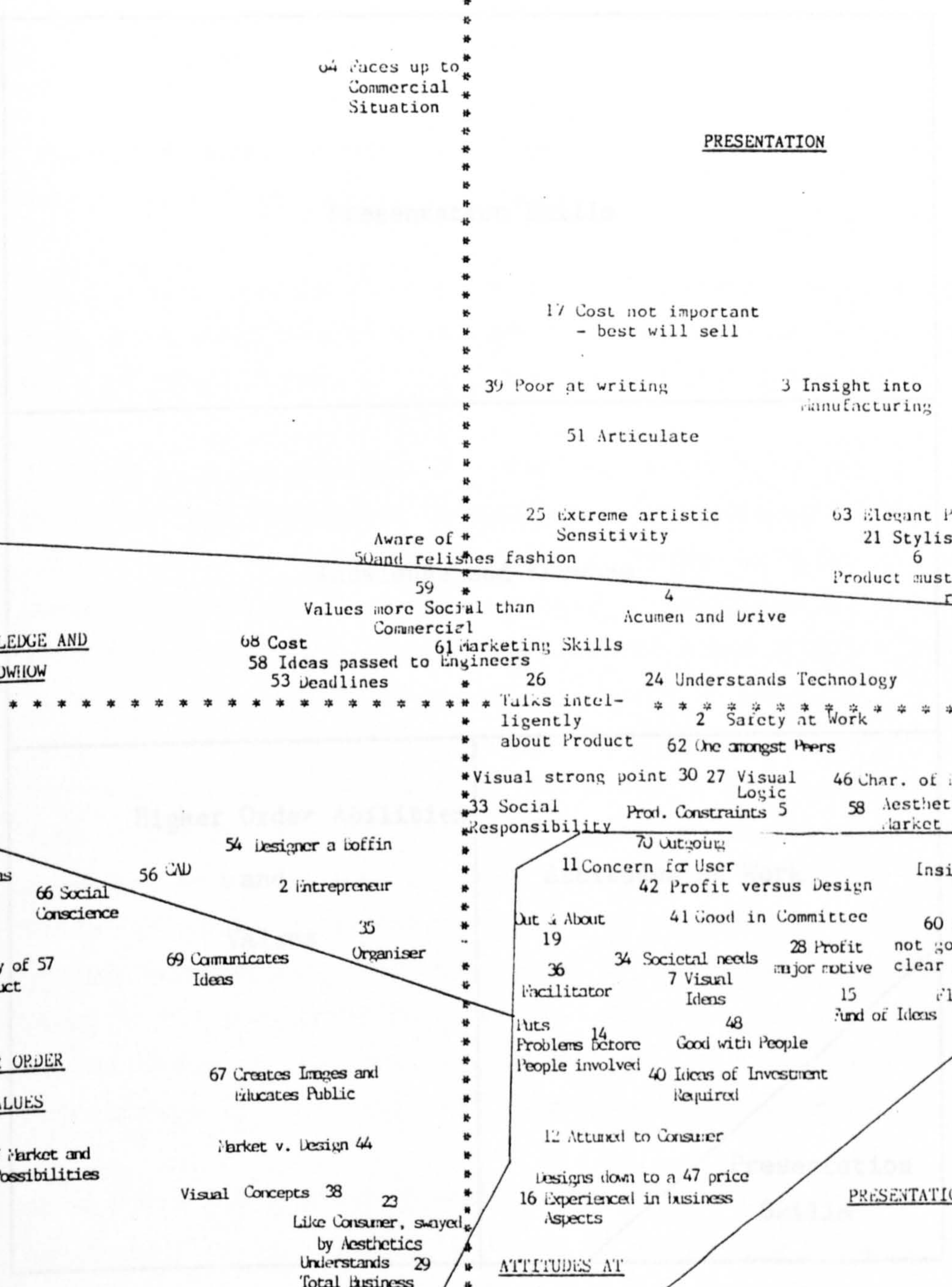
DIAGRAM 5

SPACE DIAGRAM  
SMALLEST SPACE ANALYSIS (SSA1)  
PILOT SURVEY - IDEAL



Coefficient of alienation 0.17653

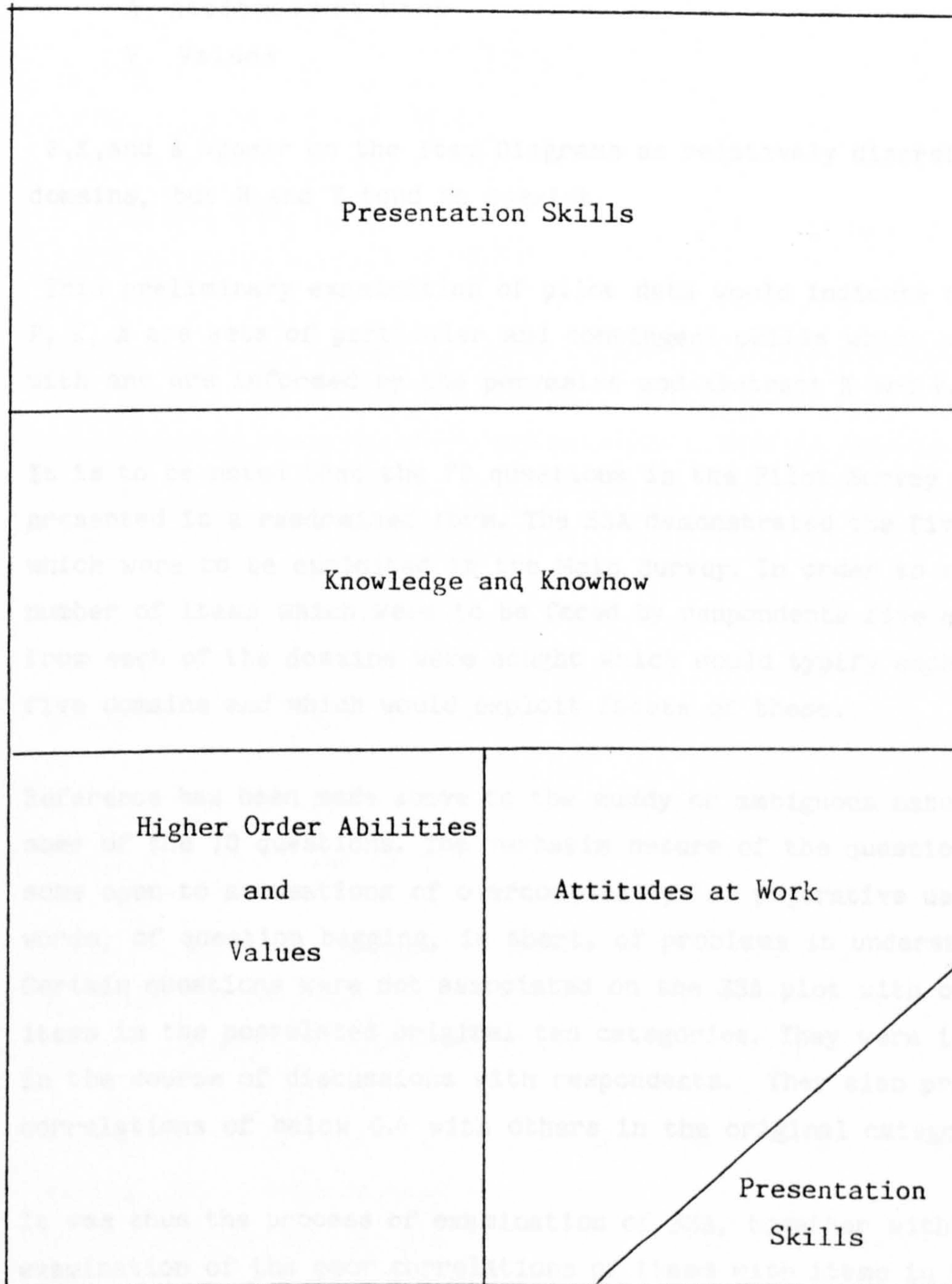






SMALLEST SPACE ANALYSIS (SSA1)

PILOT SURVEY - REAL



Coefficient of alienation 0.198644



Examination of the SSA diagrams reveals areas which fall into the following categories:

- H Abstract and Higher Order Abilities
- P Presentational Skills
- K Knowledge and Knowhow
- A Attitudes at Work
- V Values

P, K, and A appear on the Item Diagrams as relatively discrete domains, but H and V tend to coexist.

This preliminary examination of pilot data would indicate that P, K, A are sets of particular and contingent skills which combine with and are informed by the pervasive and abstract H and V.

It is to be noted that the 70 questions in the Pilot Survey were presented in a randomised form. The SSA demonstrated the five domains which were to be exploited in the Main Survey. In order to reduce the number of items which were to be faced by respondents five questions from each of the domains were sought which would typify each of the five domains and which would exploit facets of these.

Reference has been made above to the muddy or ambiguous nature of some of the 70 questions. The verbatim nature of the questions left some open to accusations of overcomplexity, of pejorative use of words, of question begging, in short, of problems in understanding. Certain questions were not associated on the SSA plot with other items in the postulated original ten categories. They were identified in the course of discussions with respondents. They also produced correlations of below 0.4 with others in the original category.

It was thus the process of examination of SSA, together with an examination of the poor correlations of items with items in the same ostensible category, and further discussion with respondents which initially led to a reduction to a possible 40 items. These items, in themselves based on interview statements, may form the basis for the Main Survey of Design.

The reduced 40 were as follows:

AESTHETIC: Q31,63,64,69

CREATIVE: Q16,21,37,51

VISUAL: Q13,33,36,44

VERBAL: Q32,38,47,57

INDUSTRIAL: Q9,15,52,55

BUSINESS: Q1,2,59,52

SOCIAL CONCERN Q17,26,49,65

MARKETING: Q18,56,61,67

FINANCIAL: Q34,46,53,74

INTERPERSONAL: Q24,28,54,76

Recognizing that there was still a need to clarify and amend, questions were sought that would avoid ambiguities, and terms that might be considered pejorative. There seemed also a need to balance the questions so that there would be the same number of questions relating to each of the five domains identified in the Pilot Study. At the same time these should represent the full dimensions of each of the five domains in terms of the 40 above. Bearing in mind that other instruments were to be used in the study - the Solomons Survey of Values, the Pattern Recognition Test and the Eysenck Personality Questionnaire - it was felt that the Survey of Design should not contain more than 50 items, that is 25 IDEAL and 25 REAL. The Survey of Design therefore contained 5 prototypic items for each of the five domains.

It was these unambiguous, short and relevant items which were used to approach and delineate the conceptual models of the Design population, using what may be termed the global and the molecular view.

The global view could be obtained using the Guttman Lingoes MDS series. SSA1 would be used to establish conceptual domains and MSA1's to distinguish between the conceptual models of different groups. Details may be found in Chapters 7 and 8.

The molecular or more detailed approach would investigate the strength of association between items. It would also investigate the process of development which was assumed to occur as Students went through their training. The method here would be Log Linear modelling. Further details of this technique are contained in Chapter 9.



## CHAPTER 6

### THE MAIN SURVEY

The Main Survey, consisting of four separate questionnaires and surveys was given to Students and Lecturers of Industrial Design at Leicester Polytechnic, Teesside Polytechnic and the Central School of Art and Design, London.

These were: Survey of Design (SD) Survey of Values (SSV) Pattern Recognition Test (PRT) Eysenck Personality Questionnaire (EPQ)

In addition the Survey of Design was given to a non-Polytechnic population of Consultant Designers and Manufacturers.

#### 6.1 Survey of Design

Following the leads provided from the Pilot Survey, a Survey of Design was formulated, consisting of 25 items. They may be understood as Design events at the simplest level, cognate with the "subordinate" category postulated by Rosch and discussed in 4.18. They represent aspects of the five domains Higher Order Skills, Presentation Skills, Knowledge & Knowhow in Industry, Attitudes at Work, and Values which are cognate with the "basic" category of Rosch.

These items were deliberately bald and simple, derived from the original verbatim content materials. By these means it was hoped to reduce the ambiguity and the overlap and conflict in meaning that had too obviously been encountered by respondents in the Pilot Survey.

As before the items were presented, firstly in the IDEAL mode and then in the REAL mode.

It was postulated that Design practitioners had evolved an IDEAL User Conceptual Model (UCM) - a kind of Design superego or conscience that might be referred to (or might be over-ridden with accompanying rationalization if the REAL situation required). The answers to the

IDEAL set of items would therefore be somewhat unworldly, but would constitute a reference position with regard to the REAL set of items.

The actual Survey of Design may be found at Appendix IV. It should be noted that the items are not randomised, but grouped in the conceptual domains derived from the SSA1 analyses of the Pilot Survey. This may be criticised on methodological grounds but the following points should be noted:

- a. The original Pilot Survey was randomised.
- b. The area of interest was that of possible linkages or associations between the conceptual domains, together with any similarities or distinction between the subgroups in this respect.
- c. Randomisation of the items would have obliged respondents to change their "set" of conception at every answer. This might introduce statistical "noise" which would be more difficult to compensate for with the relatively small sample sizes of the separate subgroups.
- d. In the Survey of Design the items are grouped but not labelled.

For the convenience of the reader the basic 25 items are listed below, together with their inferred related conceptual domain.

The Industrial Designer is (should be) skilled in:

High Order Abilities

1. Understanding and developing a client's brief
2. Creating new Design concepts
3. Devising practical Design concepts
4. "Selling" the design concept to the client
5. Conceiving alternative Design solutions

Presentation Skills

6. Presenting work visually
7. Presenting Design concepts verbally
8. Presenting Design concepts in writing
10. Marketing techniques



The Industrial Designer has (should have) an understanding of:

Knowledge & Knowhow

9. The financial implications of Design decisions
11. Relevant engineering theory and techniques
12. The law relating to professional practice
13. Normal business practice
14. Relevant volume production processes
15. Current market trends
16. Relevant computer techniques

The Industrial Designer is able to (should):

Attitudes at Work

17. Work well with other Designers
18. Collaborate well with experts from other areas
19. Have initiative and be selfmotivated
20. Work successfully to deadlines
21. Pay attention to detail

Values & Orientations

22. Have wide cultural interests
23. Think laterally
24. Be aesthetic in outlook
25. Have a social conscience

Various analyses of data from the Survey of Design are described in Chapters 7,8, 9 and 10, and certain hypotheses are explored.

## 6.2 Survey of Values

This test of value judgements was evolved in 1970 for use with Sixth Form and undergraduate populations. It is based philosophically on the ideas of Spranger (1927) and so far as its format is concerned follows the tried and tested Allport/Vernon/Lindzey Study of Values (Allport et alia 1960). Its most recent use was in 1985 at Leicester University when it was standardised on an undergraduate population from a gamut of disciplines (Brannigan 1985).

It was included in the present study for two reasons:

a. The categories used are congruent with those used in the Survey of Design.

b. Norms exist by which comparisons may be made with other undergraduate disciplines

The results from the present Industrial Design student groups are analysed, together with other results from Social Workers, Fine Arts students, Business Studies students and Maths students and are presented with comparative Value Profiles in Chapter 11

The actual Survey of Values is to be found at Appendix V.



### 6.3 The Pattern Recognition Test

This test was included because it has norms in other student and other occupational groups. It therefore, like the Survey of Values, may be used in a comparative mode. It consists of the last three sections C,D,E of Raven's Progressive Matrices, in essence a test of nonverbal intelligence and at the same time of spatial recognition.

While the question of intellectual capacity had no particular priority in the study, this measure seemed apt for Designers and could prove useful in supporting hypotheses about strength of associations with various items from the rest of the battery. See Chapter 11 for a detailed discussion on norms.

### 6.4 The Eysenck Personality Questionnaire

This Personality Test has had widespread use in the United Kingdom and there are consequently norms that may be compared with those for Industrial Design students.

Chapter 11 contains an exposition of the theoretical background of the EPQ and a discussion of the norms of Industrial Design students and other groups.

### 6.5 Survey of Design - Preliminary probes

Before the study embarked on the global and molecular approaches described in Chapters 7, 8, 9, some preliminary analyses were attempted using the data from the Survey of Design.

Three such probes were made:

- a. An examination of the "agree" responses and any differences shown by the various Design practitioner groups between IDEAL and REAL.
- b. An inspection of the correlation matrices in the practitioner groups.
- c. A Principal Components analysis.

## 6.6 Survey of Design - Differences between IDEAL & REAL responses

The Main Survey of Design data represented degrees of agreement or disagreement with statements purporting to sample the activity or behaviour involved in the process of Design. The gamut of responses ran from Definitely Agree and Largely Agree through to Largely Disagree and Definitely Disagree.

The objective was to detect consistent patterns in these responses that would point to similarities or differences in the conceptual models typically used by the Design practitioner groups, that is Student, Lecturer, Designer, Manufacturer.

The initial approach was concerned with the "Agree" responses, defined as scores 5 and 6, that is "Largely and Definitely Agree". The percentage of respondents scoring these of the 25 statements in the Design Survey.

A problem of interpretation of the percentage per se arises. The problem is one of intensity versus frequency of occurrence. It is perhaps more evident if one takes the middle range - medium scores apportioned by an individual to a particular item. A medium score could indicate that the behaviour cited in an item was important but occurred relatively infrequently in the normal course of the Design process. On the other hand the behaviour might occur frequently but was considered relatively unimportant. In either case a medium score may be the response. No account of the frequency of use is made in the Survey of Design and further studies might examine this aspect.

A more directly accessible meaning may be derived from both percentages if the distance between IDEAL and REAL is considered. Whatever "importance" is attributed - highly important but relatively infrequent, or relatively important but very frequent in occurrence, the convergence between IDEAL and REAL may be construed as a measure of satisfaction with that particular item.

These percentages were computed firstly for the complete sample and then for the four Status groups - Student, Lecturer, Designer,



Manufacturer. Tables showing these percentages follow, firstly in order of questions ( Tables 1,2,3,4,5) and then in rank order of agreement ( Tables 6,7,8,9,10). These are further shown in the Graphs facing the relevant Tables.

Attention is also directed to the relationship between the "Agree" percentages in IDEAL and REAL. It had been surmised that the IDEAL responses might simply agree with the statement, since the behaviour described had been thought of as Design desirable. In that case the IDEAL "Agree" percentages would have been 100%, and the focus of the study would have been on the REAL responses per se.

This is obviously not the case and although mismatches between IDEAL and REAL are evident, some more relative measure of mismatch was necessary. taking account of the IDEAL variation.

Two indices of mismatch were devised:

- a. A straightforward index of difference between IDEAL and REAL
- b. An index of the ratio between REAL and IDEAL to give some relative measure.

In the event the results from each method were very similar and in this chapter the Index of difference has been used. The results obtained using the Index of ratio are to be found in Appendix VIII.

Whereas the percentage "Agree" figures in themselves represent the importances which they assume within a certain mode - IDEAL or REAL, the mismatch indices would give a measure of perception of the real world. The score given by an individual to any IDEAL Question, for example, ought to be related to the corresponding REAL Question, since one might affect the other.

Figures are now given below in Tables 1 to 5, firstly the "Agree" percentages for IDEAL and REAL with the Index of Difference and the Rank Order within this Index, secondly the top and bottom five ranks and a discussion of these.

### 6.6.1. Differences in the complete sample

The following table presents the complete set of questions setting out the percentage scoring 5 and 6 for both IDEAL and REAL, the difference between these percentages, and the convergence between the percentages, expressed in rank order.

Table 1 Percentage differences IDEAL and REAL  
for "Agree" Responses - Complete sample

| <u>HIGHER ORDER ABILITIES</u>     | IDEAL | REAL | DIFF | RANK |
|-----------------------------------|-------|------|------|------|
| 1. Understand and develop brief   | 99.5  | 79.6 | 19.9 | 3    |
| 2. Create new Design concepts     | 92.0  | 61.4 | 30.6 | 15   |
| 3. Devise practical concepts      | 93.6  | 62.7 | 30.9 | 16   |
| 4. "Sells" design concepts        | 87.3  | 61.2 | 26.1 | 8    |
| 5. Conceives alternative concepts | 90.6  | 65.7 | 24.9 | 7    |
| <u>PRESENTATION SKILLS</u>        |       |      |      |      |
| 6. Visual presentation            | 94.5  | 91.6 | 2.9  | 1    |
| 7. Oral presentation              | 78.8  | 52.0 | 26.8 | 9    |
| 8. Written presentation           | 56.2  | 28.7 | 27.5 | 11   |
| 10. Marketing techniques          | 60.6  | 31.2 | 29.4 | 13   |
| <u>KNOWLEDGE &amp; KNOWHOW</u>    |       |      |      |      |
| 9. Knows financial implications   | 87.2  | 45.1 | 42.1 | 23   |
| 11. Understand engineering theory | 88.6  | 59.9 | 28.7 | 12   |
| 12. Understand prof law           | 71.4  | 34.5 | 36.9 | 20   |
| 13. Understands business practice | 75.3  | 41.8 | 33.5 | 18   |
| 14. Understands production method | 84.6  | 60.4 | 24.2 | 6    |
| 15. Understands market trends     | 98.6  | 69.2 | 29.4 | 13   |
| 16. Knows relevant computing tech | 67.8  | 24.9 | 42.9 | 24   |



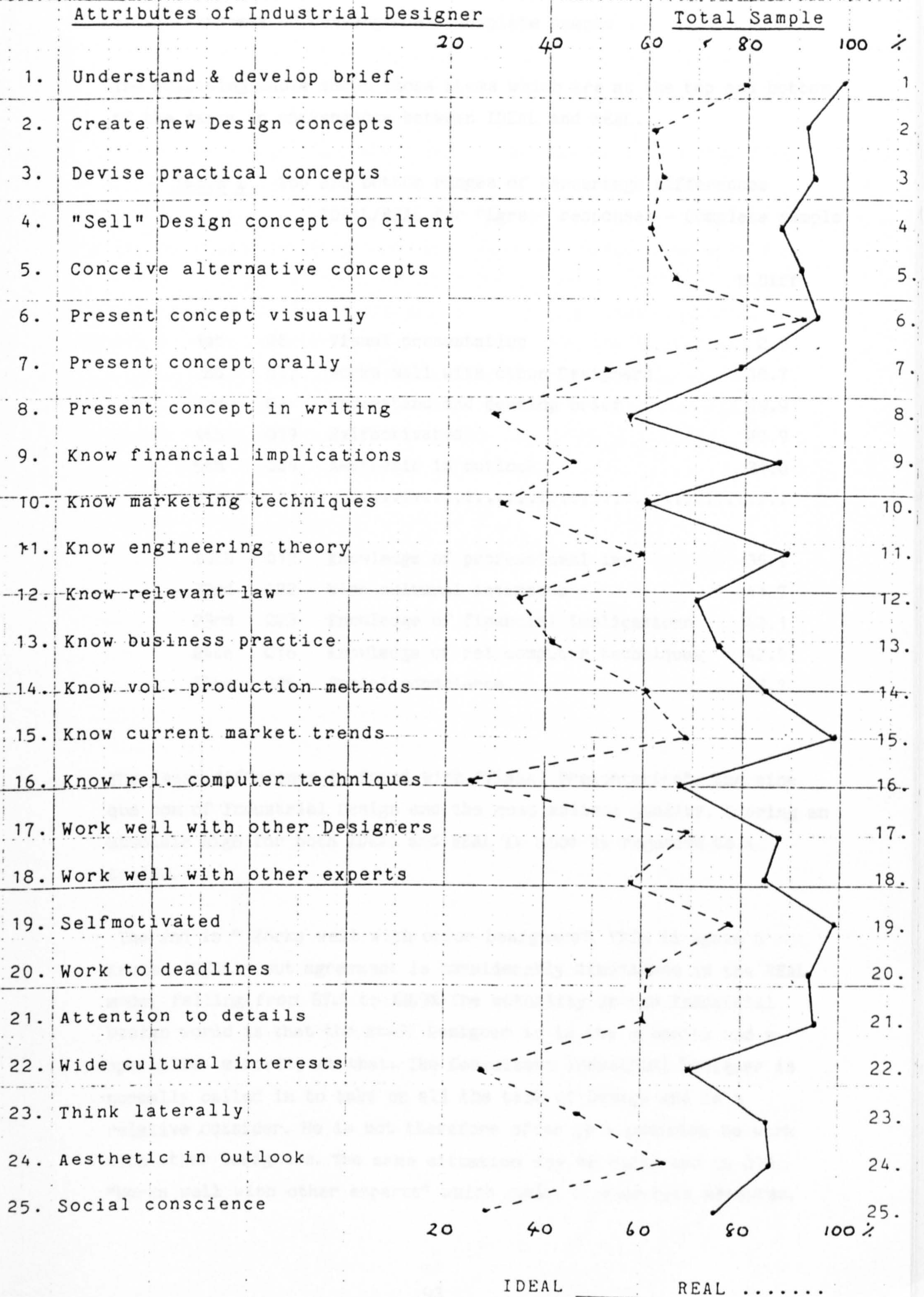
| <u>ATTITUDES AT WORK</u>          | IDEAL | REAL | DIFF | RANK |
|-----------------------------------|-------|------|------|------|
| 17. Works well with Designers     | 87.6  | 68.9 | 18.7 | 2    |
| 18. Works well with other experts | 85.1  | 58.2 | 26.9 | 10   |
| 19. Self motivated                | 98.5  | 77.6 | 20.9 | 4    |
| 20. Sense of deadlines            | 94.0  | 61.5 | 32.5 | 17   |
| 21. Sense of detail               | 95.1  | 60.2 | 34.9 | 19   |

| <u>VALUES &amp; ORIENTATIONS</u> |      |      |      |    |
|----------------------------------|------|------|------|----|
| 22. Wide culture                 | 69.8 | 28.1 | 41.7 | 22 |
| 23. Thinks laterally             | 84.7 | 47.8 | 36.9 | 20 |
| 24. Aesthetic                    | 86.2 | 65.2 | 21.0 | 5  |
| 25. Social conscience            | 75.3 | 29.6 | 45.7 | 25 |



# PERCENTAGES OF "AGREE" RESPONSES IN SURVEY OF DESIGN

DIAGRAM 8





## 6.6.2 Extremes of convergence - complete sample

The following table shows those items which are at the top and bottom of the range in convergence between IDEAL and REAL.

Table 2 Top and bottom ranges of Percentage differences  
IDEAL/REAL for "Agree" responses - Complete sample

|       |     |                                      | % Diff |
|-------|-----|--------------------------------------|--------|
| 1st   | Q6  | Visual presentation                  | 2.9    |
| 2nd   | Q17 | Works well with other Designers      | 18.7   |
| 3rd   | Q1  | Understand and develop brief         | 19.9   |
| 4th   | Q19 | Selfmotivated                        | 20.9   |
| 5th   | Q24 | Aesthetic in outlook                 | 21.0   |
| ..... |     |                                      |        |
| 20th  | Q12 | Knowledge of professional law        | 36.9   |
| 22nd  | Q22 | Wide cultural interests              | 41.7   |
| 23rd  | Q23 | Knowledge of financial implications  | 42.1   |
| 24th  | Q16 | Knowledge of rel computer techniques | 42.9   |
| 25th  | Q25 | Social conscience.                   | 45.7   |

The least difference is found with "Visual Presentation", the sine qua non of Industrial Design and the most salient quality. Scoring an absolute high for both IDEAL and REAL it must be regarded as a truism.

The 2nd is "Works well with other Designers". This is again a truism IDEALLY but agreement is considerably diminished in the REAL mode, falling from 87.6 to 68.9% The actuality in the Industrial Design world is that the Staff Designer is in the minority and a specialist minority at that. The Consultant Industrial Designer is normally called in to take on all the task of Design and is a relative outsider. He is not therefore often in a position to work with other Designers. The same situation may be reflected in Q18 "Works well with other experts" which ranks 10th on both measures.

The 3rd is "Understand and develop brief". This is regarded as an Ideal by 99.5 % of all respondents, but drops to 79.6 when reality obtrudes.

The 4th is " Self motivated". Here 98.5% regard it as a truism which drops away in practice.

5th is "Aesthetic in outlook" but this would seem to maintain this position because of the lower starting percentage in IDEAL. There have been indications in the Historical chapter that conceptual models change at intervals from Aesthetic priority to Pragmatic priority. These periods of change tend to correspond to periods of social or economic flux in society. It would appear reasonable to explain the misgivings and relatively low priority given in the Survey along some such lines.

.....

20th is "Thinks laterally" and this is surprising in view of the stress ostensibly paid to innovation and creativity. There is a large mismatch (84.7% to 47.8%) here and this may well reflect lack of opportunity to act creatively or possibly to get creative ideas implemented.

22nd is "Wide cultural interests" and while the IDEAL percentage is relatively high (69.8%), there is a massive mismatch with REAL (28.1)

23rd is "Knowledge of financial implications" and here again the interpretation of such a large mismatch might be similar to that for Question 12, "Knowledge of law". IDEALLY financial considerations should be borne in mind. In practice it is probably left to the experts.

24th is "Knowledge of relevant computer techniques". Here the IDEAL response is low at 67.8% and the REAL is the lowest. One may only conjecture that this is a reaction of ignorance and possibly fear. A thorough-going study of the attitudes of Designers and the computer might well prove fruitful, but this is not within the remit of this study.

25th is "Social conscience" and it would seem that while not extremely high in priority in IDEAL there is virtually no place for such a luxury in actuality.



### 6.6.3 Extremes of convergence - Students and Lecturers

The following table shows those items which are at the top and bottom of the range so far as the Polytechnic sample is concerned.

Table 3 Top and bottom ranges of percentage difference for  
"Agree" responses IDEAL/REAL - Students & Lecturers

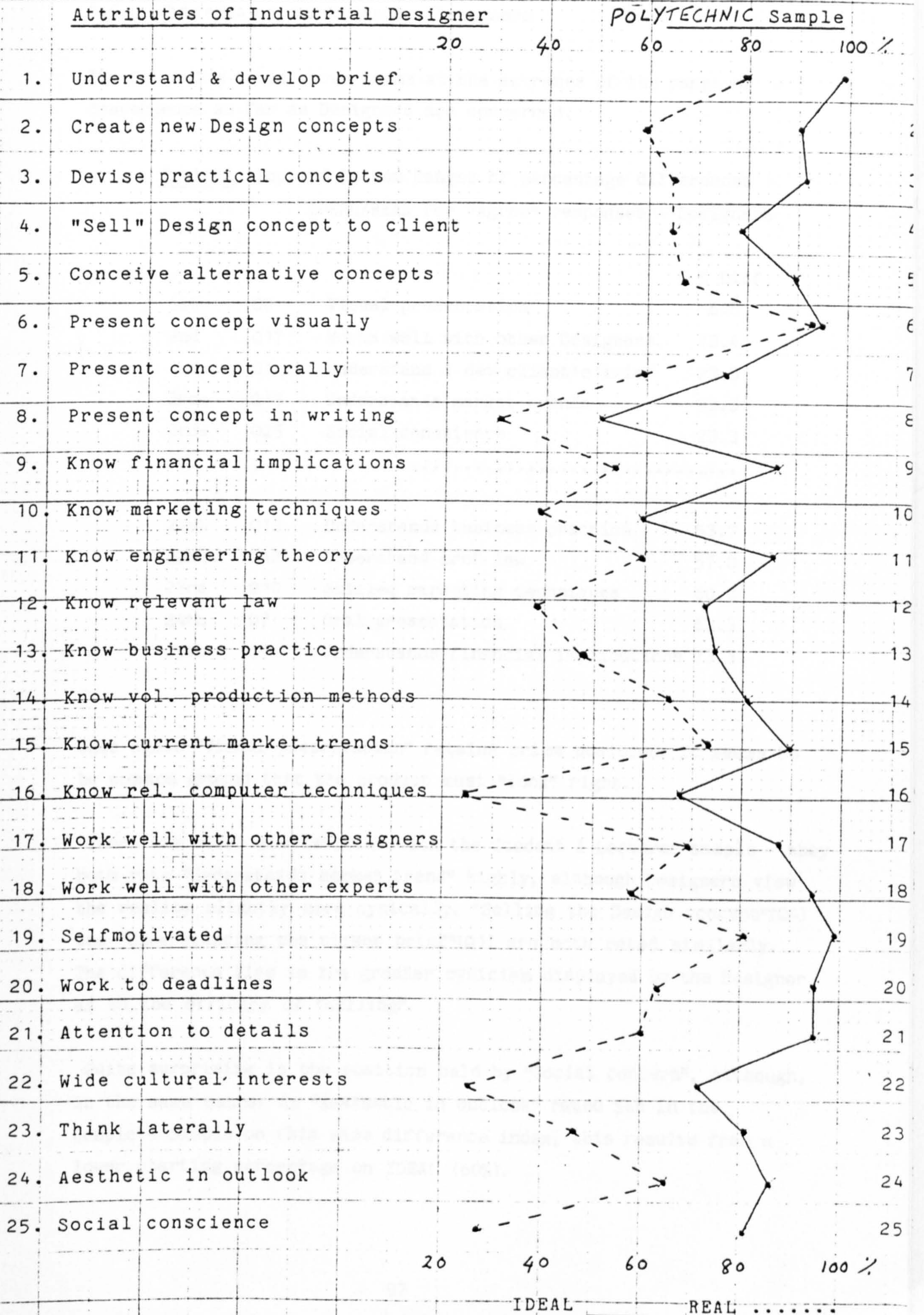
|       |     |                             | % Diff |
|-------|-----|-----------------------------|--------|
| 1st   | Q6  | Visual presentation         | 1.8    |
| 2nd   | Q15 | Understands market trend    | 14.7   |
| 3rd   | Q4  | "Sells" design concept      | 14.8   |
| 4th   | Q14 | Understands prod methods    | 16.1   |
| 5th   | Q18 | Selfmotivated               | 18.8   |
| ..... |     |                             |        |
| 21st  | Q12 | Understands prof law        | 34.0   |
| 22nd  | Q23 | Thinks laterally            | 34.1   |
| 23rd  | Q16 | Relevant computer technique | 42.4   |
| 24th  | Q22 | Wide cultural interests     | 45.9   |
| 25th  | Q25 | Social conscience           | 53.5   |

As in the Complete Sample "Visual presentation" takes pride of place, but apart from "Selfmotivated", the other priorities differ at the top end. On the other hand, there is remarkable correspondence at the lower end of the scale.



# PERCENTAGES OF "AGREE" RESPONSES IN SURVEY OF DESIGN

DIAGRAM 9





#### 6.6.4 Extremes of convergence - Designers

The following table shows items at the extremes of the range of convergence so far as Designers are concerned.

Table 4 Top and Bottom Ranges of percentage differences  
IDEAL/REAL for "Agree" responses - Designers

|       |     |                                    | % Diff |
|-------|-----|------------------------------------|--------|
| 1st   | Q6  | Visual presentation                | 6.8    |
| 2nd   | Q17 | Works well with other Designers    | 13.4   |
| 3rd=  | Q1  | Understand & dev client's brief    | 23.3   |
| 3rd=  | Q15 | Understands market trends          | 23.3   |
| 3rd=  | Q25 | Social conscience                  | 23.3   |
| ..... |     |                                    |        |
| 21st  | Q13 | Understands business practice      | 53.7   |
| 22nd  | Q12 | Understand prof law                | 57.0   |
| 23rd  | Q10 | Skilled marketing techniques       | 60.0   |
| 24th  | Q7  | Oral presentation                  | 63.3   |
| 25th  | Q9  | Understands financial implications | 73.3   |

Once again "Visual presentation" retains prime position. It seems to be common ground that the product must "look" right.

There are other similarities with the Student & Lecturer sample - they both rate "Understands market trend" highly, although Designers view the reality slightly more cynically. "Selling the Design concept"(Q4) and "Understanding the client brief"(Q1) are both rated similarly. The difference lies in the greater cynicism displayed by the Designer as to the efficacy of "selling".

Quite surprising is the position held by "Social concern", although, in the same manner as "Aesthetic in outlook" rated 5th in the Complete Sample on this same difference index, this results from a lower starting percentage on IDEAL (60%).

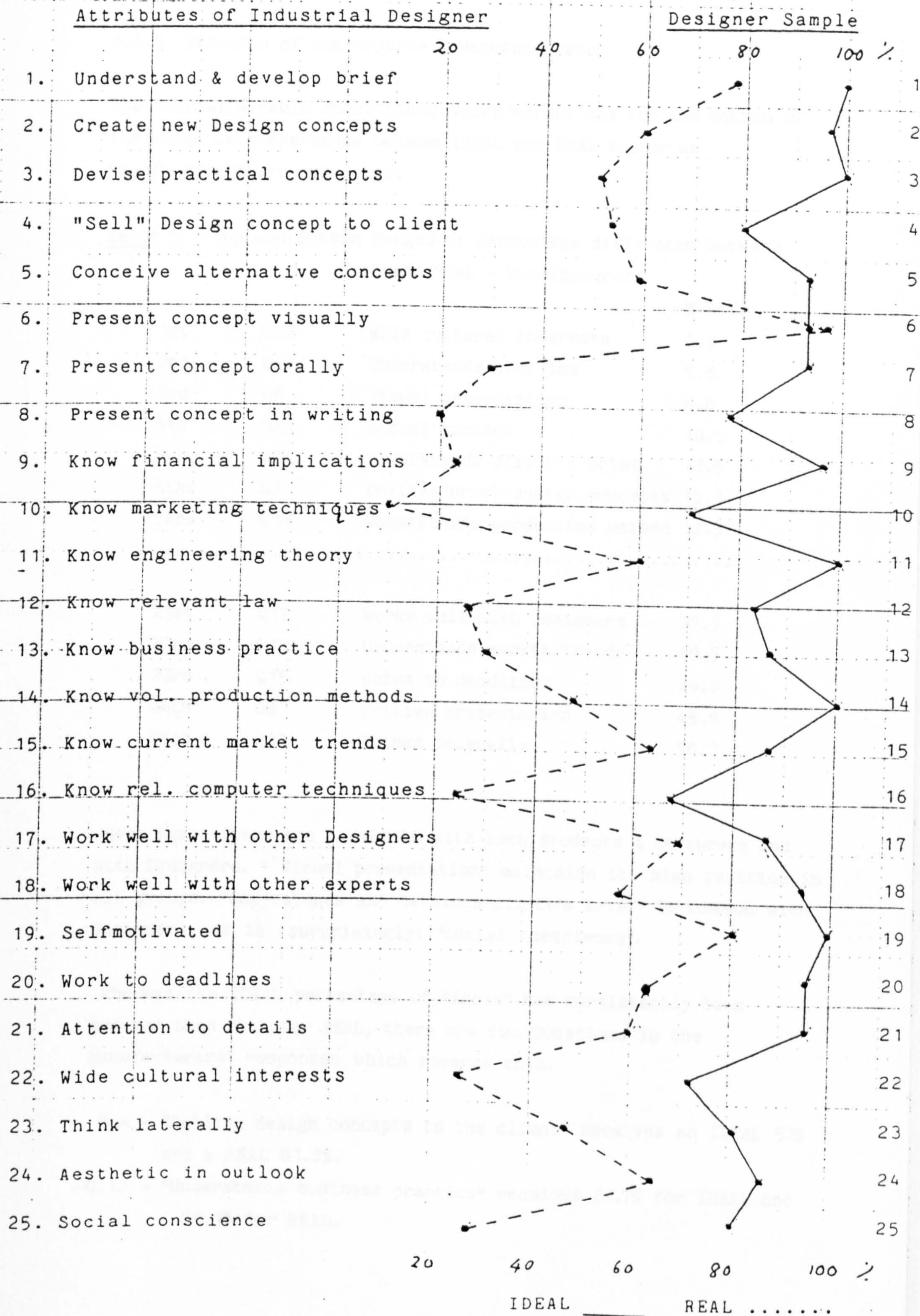
At the other end of the scale there come what may be termed extraneous Design activities and it seems that in these there are great gaps between the IDEAL and the REAL. Designers would view as important the activities of understanding business practice, professional aspects of law as applying to Design, and the financial implications of Design. But they see themselves as debarred or shut out from these fields. Whether this is because of a lack of capacity on their part or because Manufacturers do not see their role as extending to these fields is not certain.

Insofar as "Oral presentation" is concerned, there is no doubt in their mind that IDEALLY it is important (93.3% Agree), but in practice the talent is missing (30% Agree).

Marketing techniques are not regarded as extremely relevant, in contrast with "Understanding market trends". This would seem even IDEALLY to be extraneous (70% Agree) and minimal in REAL terms (10% Agree). Designers are not salesmen.



DIAGRAM 10





#### 6.6.5 Extremes of convergence - Manufacturers

The following table shows items which occupy the top and bottom of the range in convergence between IDEAL and REAL so far as Manufacturers are concerned.

Table 5 Top and Bottom Ranges of percentage difference between  
IDEAL and REAL - Manufacturers

|       |     |                               | % Diff |
|-------|-----|-------------------------------|--------|
| 1st   | Q22 | Wide cultural interests       | 3.3    |
| 2nd   | Q12 | Understands prof law          | 5.5    |
| 3rd   | Q6  | Visual presentation           | 6.6    |
| 4th   | Q25 | Social concern                | 10.5   |
| 5th=  | Q1  | Understands client's brief    | 12.5   |
| 5th=  | Q3  | Devises pract design concepts | 12.5   |
| 5th=  | Q14 | Understands production method | 12.5   |
| ..... |     |                               |        |
| 21st  | Q17 | Works well with Designers     | 37.5   |
| 22nd  | Q15 | Understands market trends     | 40.5   |
| 23rd  | Q15 | Works to deadlines            | 44.0   |
| 24th  | Q8  | Written presentation          | 45.9   |
| 25th  | Q23 | Thinks laterally              | 50.3   |

Here again there are parallels with both Students & Lecturers and with Designers. " Visual presentation" maintains its high position in all groups. "Understands and develops client's brief" is common with Designers, as is (surprisingly) "social conscience".

Whereas the IDEAL percentage of "Agree" has consistently been greater than that for REAL, there are two Questions in the Manufacturers' responses which reverse this.

Q.4 - "Selling design concepts to the client" receives an IDEAL 53% and a REAL 81.3%.

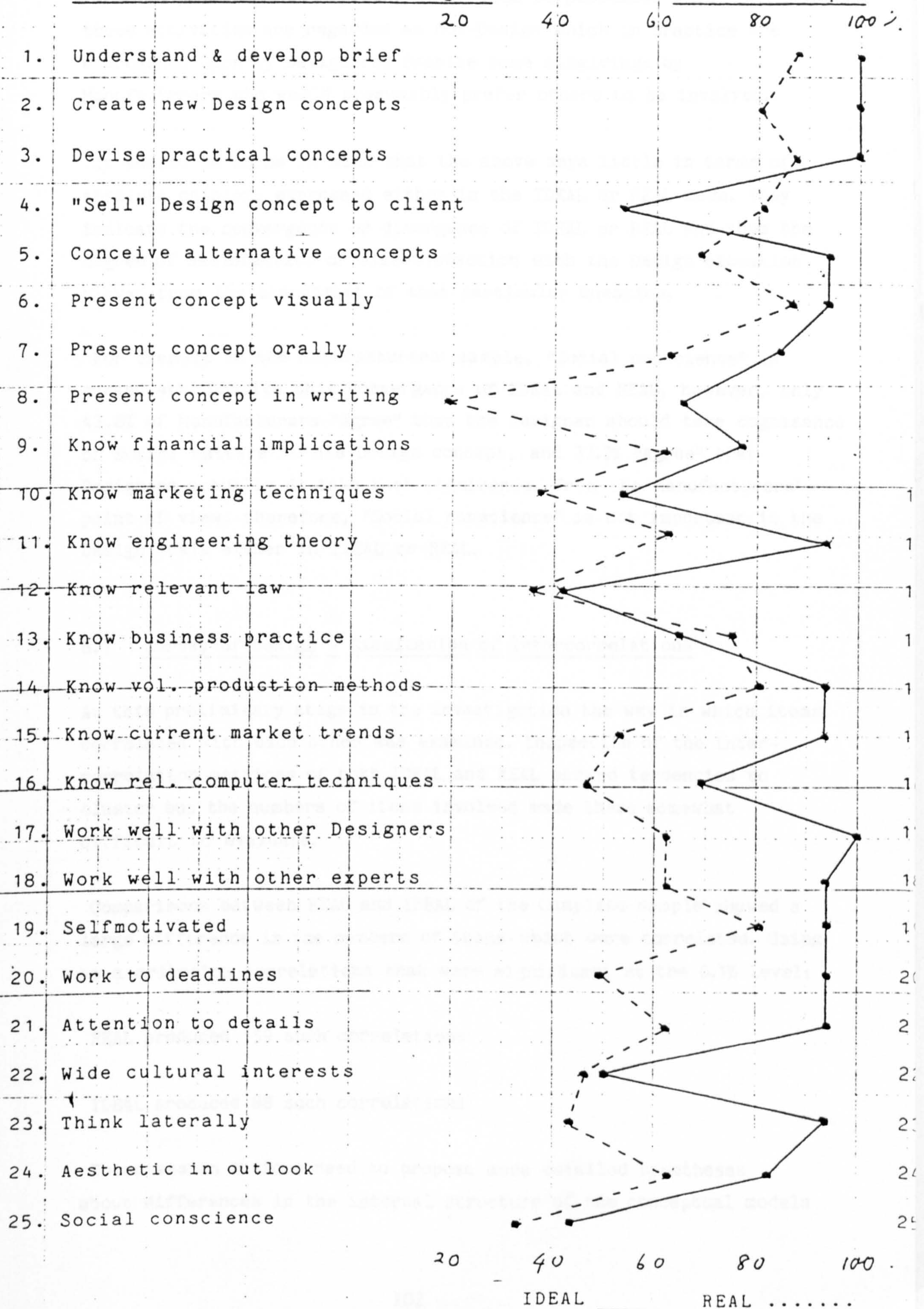
Q.13 - "Understands business practice" receives 64.7% for IDEAL and 75.1% for REAL.



DIAGRAM 11

Attributes of Industrial Designer

MANUFACTURER Sample





This is difficult to explain, other than to postulate that these activities are regarded as non-Design which in practice are encroached upon by Designers, despite some misgivings by Manufacturers who would presumably prefer others to be involved.

It should be borne in mind that the above says little in terms of absolute opinions expressed either in the IDEAL or REAL mode. They indicate the convergence or divergence of IDEAL or REAL and thus the degree of satisfaction or dissatisfaction with the Design situation viewed from the standpoint of that particular Question.

For example in the Manufacturers' sample, "Social conscience" is ranked 4th. Despite this convergence of IDEAL and REAL, however, only 43.8% of Manufacturers "Agree" that the Designer should take cognisance of social matters in his Design concept, and 33.3% "Agree" that Designers actually do take such cognisance. From the Manufacturers' point of view, therefore, "Social conscience" is not important in the Design scale either in IDEAL or REAL.

#### 6.7 Survey of Design - Examination of Intercorrelations

At this preliminary stage in the investigation the way in which items correlated with each other was examined. Inspection of the inter-correlation matrices of both IDEAL and REAL showed tendencies to cluster but the numbers of items involved made these somewhat difficult to evaluate.

Comparisons between REAL and IDEAL of the Complete sample showed a large difference in the numbers of items which were correlated. Using as a criterion correlations that were significant at the 0.1% level:

REAL produced 159 such correlations

IDEAL produced 88 such correlations

There was an obvious need to propose more detailed hypotheses about differences in the internal structure of the conceptual models



involved and it was for this reason that at a later stage of the study more sophisticated analysis, using Multidimensional Scalogram techniques examines clustering from a multivariate point of view.

Nevertheless, trends may be seen and some comments made at this stage.

#### 6.7.1 Comparisons between Institutions

The patterns of Pearson's  $r$  correlations between Institutions may sustain the Hypothesis of an Institution effect. The matrix of correlations in all subsequent tables is 25 x25. There are parallel patterns between IDEAL and REAL and this may be seen in the tables below of correlation counts at a conventional 5% level.

Table 6 Significant correlations between Survey of Design items  
Institutions - IDEAL

|          | p=< .05 | n  |
|----------|---------|----|
| Leics    | 213     | 55 |
| Teesside | 203     | 57 |
| London   | 157     | 38 |

Table 7 Significant correlations between Survey of Design items  
Institutions - REAL

|          | p=< .05 | n  |
|----------|---------|----|
| Leics    | 406     | 55 |
| Teesside | 179     | 57 |
| London   | 128     | 38 |

In the IDEAL there is a systematic difference in the number of significant correlations, with Leicester and Teesside greater in numbers than London. The interpretation is difficult since the question may not be simply absolute numbers but how they are distributed and patterned.

If, for example, an increase in total correlations in a group may be accounted for within the elements of the same conceptual model and not between models, this could signify cognitive complexity.

Bieri (1966) considers that cognitively more complex persons are more likely to code the full range and subtleties of experience, including their inevitable contradictions. Cognitively more simple persons are likely to ignore information that denies or contradicts the univalent impression they are likely to have. They oversimplify.

Absolute numbers of correlations ideally need to be broken down into correlations within and those between domains. Bieri (1966) proposed a way of scaling this relative complexity, but the problem of defining clusters by visual inspection of large matrices of correlations is severe and it was for this reason that more sophisticated methodology was employed later in the research. In this preliminary phase no such distinction was made and interpretation is therefore tentative.

In the REAL the difference becomes more obvious. It is noteworthy that the contribution of Leicester Polytechnic is over twice that of Teesside and over three times that of London.

Table 8 Significant correlations between Survey of Design items  
Years, Lecturers, Designers, Manufacturers - IDEAL

|                | p=> .05 | n  |
|----------------|---------|----|
| Year 1.        | 263     | 51 |
| Year 2.        | 220     | 32 |
| Year 3.        | 145     | 35 |
| Year 4.        | 131     | 17 |
| Years 4+5.     | 140     | 26 |
| Lecturers.     | 49      | 12 |
| Designers.     | 234     | 31 |
| Manufacturers. | 195     | 17 |



### Students

These correlations at the 5% level, diminish in numbers as the course progresses. The SSA plots ( see Chapter 7) show conceptual domains that are well defined and the interpretation that may be placed on the systematic diminution of totals of significant correlations between the variables could well be that these conceptual domains are being refined and defined throughout the course. This curvilinear progress has been noted by Runkel & Damrin (1961) in the training of teachers, starting with a wide repertory , narrowing down until they viewed their subjects narrowly, and then as they entered teaching itself, elaborating a more complex view.

### Lecturers

The number of correlations in IDEAL is small. This is disconcerting and may point towards a compartmentalising of concepts.

### Designers

There is a rise in the numbers of correlations and this would seem to represent an acknowledgement of experience, a colouring of reality that alters to some degree the IDEAL frame of reference.

### Manufacturers

To a slightly lesser extent the IDEAL domain is richer than that of the Student and presumably for the same reason as obtained for the Designers.

Table 9 Significant correlations between Survey of Design items

Years, Lecturers, Designers, Manufacturers - REAL

|            | p<= .05 | n  |
|------------|---------|----|
| Year 1.    | 191     | 51 |
| Year 2.    | 144     | 32 |
| Year 3.    | 156     | 35 |
| Year 4.    | 226     | 17 |
| Years 4+5. | 196     | 26 |
| Lecturers  | 150     | 12 |
| Designers  | 379     | 31 |
| Manufrs    | 172     | 17 |

## Students

After an initial surge in Year 1, these correlations show a progression from Year 2 to the postgraduate Years 4 and 5. Year 1 students have little or no course experience and it may be that at this stage in the course students have in fact had little real contact with the conditions which obtain in actual Design. The status of these correlations is therefore suspect, and the wider reality base of the subsequent years becomes more and more developed and valid as the course goes on.

At the beginning of their specialist course students would seem to be already equipped with conceptual models which are based on "common sense" observation. What follows is a process of sifting experience, finding successively more and more general cases which will serve as principles to explain the more special cases.

It may be supposed that "naive" students begin with unsophisticated and undiscriminated perceptions of the Design world. Some of these are compatible with formal teaching - the input of lecturers etc, and are thus encouraged insofar as they correspond to textbook concepts. Some are cut down, lose their status as guiding ideals and are assimilated to more fundamental and higher priority concepts.

But there also seem to be two distinct frames of reference and thus two conceptual models:

The IDEAL and the REAL are not very different at first, but whereas the IDEAL is steadily made more parsimonious under the influence of the Institution, the REAL relations are slowly but surely and systematically rebuilt under the influence of relevant experience until eventually the full conceptual model of Designers is achieved.

## Lecturers

It is noted that, whereas the number of REAL intercorrelations has increased with respect to the IDEAL, they are comparable to those for Years 2 and 3, although they are not of the same order as that for Designers.



together and are also linked both to Presentation questions 6 and 7 and also to Knowhow questions 11,12 and 14.

In REAL, the Manufacturer shows clusters of association between the Value questions 22-24, and these in turn are linked to the High Order questions 3 and 4 which both involve practical matters. Value for the Manufacturer seems pragmatic in tone. Again High Order questions 3 and 4 associate with Presentation questions 7-10.

#### 6.8 Survey of Design - Principal Components Analysis

Following the correlation count method described above a Principal Components Analysis (PCA) was performed. This is a method of deriving a smaller number of components to represent a larger number of tests. The general use of Principal Components is to explore the patterning of variables and as a summary device to construct simpler components for future testing.

PCA is a mathematical technique that does not require an underlying statistical model to "explain" the error structure. This in turn means that the sampling behaviour of the eigenvalues is not known and there is therefore no objective way of deciding how many eigenvalues are significantly "large". Another consequence is that it is difficult to compare the components obtained from two or more samples. Care needs to be exercised in interpreting the meaning of components.

Factor Analysis has an underlying statistical model but it requires firm assumptions of normality and linearity which are not justified in the subjective categorical data of the study. It was therefore not pursued.

PCA was used in a preliminary and exploratory way since there were difficulties in discerning distinct patterns in a large mass of correlations between the variables. It was hoped to compare the loading patterns in the first three components of status groups, using the Score coefficients.

An overall view may be gained from Table 10. There are indications of separate patterns or structures in the conceptual models of various groups, but it was not possible to say more than this at this exploratory stage, given the difficulties inherent in interpretation in PCA noted above.

It may be seen from Table 10 that this is a complex set of data and an indication of this complexity is to be found with the number of Components identified and the spread of variability right throughout the Components. A lead to the structure is to be found in the Eigenvalues and the percentage covered by the first Component.

In IDEAL the only group of note is Manufacturers. In this group the first Component out of six represents 44.2% of the variability. The other groups in IDEAL have no such significant Component 1, and in fact no analysis at all emerges for Lecturer or Designers. It may only be concluded that Students, as opposed to Manufacturers are far more varied in conceptual model.

In REAL there is also a net difference between Students (Years 1,2,3) and the other groups. There seems also a difference between undergraduate and post graduate Students, with more affinity between the latter and Lecturers, Designers, and Manufacturers.

The situation is simpler with Manufacturers (Eigenvalue 10.1505), Lecturers (Eigenvalue 12.88) and Designers (Eigenvalue 10.4491). While any concise interpretation of these results is difficult, there would seem to be differences between Undergraduates, Postgraduates, Lecturers, Designers and Manufacturers, and this is in line with ideas emerging from Multidimensional Scalogram Analysis and Loglinear Analysis still to be discussed in Chapters 7, 8, 9, and 10.

A more detailed picture may be derived by extracting what SPSS terms the Factor Score Coefficient Matrix. This expresses the components in terms of the respective loadings of the variables. Discussion of the first three components follows. A computer printout of these is to be found at Appendix VI.



## IDEAL

No analysis was forthcoming for Lecturers since for one of the variables, Item 20 ( The Designer should work successfully to deadlines), there was unanimity in agreement and hence zero variance.

No analysis was forthcoming for Designers because of missing values.

For Students and Manufacturers there are distinct differences in the first three components of the PCA in the loading of the 25 variables.

### 1. Students

Component 1 (28.5%) stresses knowledge with items 9 to 14. These include financial, engineering, marketing, production processes, legal and business practice.

Component 2 (7.6%) stresses values with items 22 to 25. These are cultural, creative, aesthetic and social values.

Component 3 (7.1%) stresses interpersonal and personality qualities with items 17 to 21. These include collaboration with other Designers and experts, self-motivation and self discipline.

### 2. Manufacturers

Component 1 (44.2%) stresses personality and discipline with items 18 to 21 and also visual presentation and knowledge of production processes with items 6 and 14.

Component 2 (11.8) stresses knowledge of financial matters and marketing with items 9 and 10, but also working with others with 16, 17, 18.

Component 3 (10%) is concerned with practicality and versatility with stress laid on items 1, 3, 11, and 23.

## REAL

### 1. Students

Component 1 (27.3% of variance) shows larger loadings in items 1,3,4 - all higher order skills; 10,12,13 - marketing, law and business practice. There is a contrasting negative loading in 17,18 - attitudes at work.

Component 2 (9.7%) stresses items 2,3,5,16 - creating practical and alternative concepts and computer techniques; and interpersonal skills (17,18). By contrast there is a negative loading on 24 - aesthetic outlook.

Component 3 (6.3%) stresses values and cultural interests (22-25).

### 2. Lecturers

Component 1 (51.5%) stresses item 5 alternative design solutions- and 9,10,11,14 - finance and marketing, engineering theory and volume production. This is a pragmatic component.

Component 2 (10.1%) stresses "selling" the product to the client, presenting ideas orally and in writing and by computer (4,7,8,16). It also covers interpersonal skills (17,18).

Component 3 (8.8%) stresses Attitudes at work (19,20), and Values(22-25).

### 3. Designers

Component 1 (41.8%) stresses presenting the product (4,10) coupled with knowledge of the market and business procedures (13,15). It also stresses 19,20 - interpersonal and self knowledge. By contrast there is a negative loading on 8 - presenting concepts in writing.

Component 2 (9.2%) stresses 19,21 - collaboration with peers and attention to detail; it stresses values with 23,24,25 - lateral thinking, aesthetic outlook and social awareness.



Component 3 (7.9%) stresses detailed application to the client's brief in 1,3,21; it stresses background knowledge in 11,12,13,14 - engineering, law, business practice, production processes. This contrasts with a negative loading on 22 - cultural interests.

#### 4. Manufacturers

It did not prove possible to extract a Score coefficient matrix, because of ill-conditioned data.

#### 6.8.1 Discussion

Principal Components Analysis has provided a useful preliminary and investigatory instrument to explore the data. It is to be noted that parallels may be drawn with the more sophisticated and detailed analysis of Loglinear modelling, to be met later in Chapters 9 and 10.

In IDEAL Loglinear analysis reveals differences linked to the various status subgroups in regard to Higher Order Abilities and to Values. In Principal Components Analysis, Students stress Values. In Loglinear analysis Manufacturers stress Presentation Skills with a preoccupation with Visual as they do in PCA. The general division is between theoretic and practical.

In REAL Loglinear analysis shows differences in Attitudes at Work and Presentational skills linked to status subgroups. In Principal Components Lecturers stress Attitudes at Work, and so do Students, albeit with a negative loading. Lecturers stress Presentation and so do Designers - with a negative loading for writing skills, one of the preoccupations and concerns of the Manufacturer.

**Table 10** Summary of Principal Components Analysis  
Survey of Design  
IDEAL

| Group     | Percentage in<br>Component 1 | Number of<br>Components | Cumulative<br>Percentage |
|-----------|------------------------------|-------------------------|--------------------------|
| Students  | 28.5                         | 8                       | 66.2                     |
| Lecturers | No analysis                  |                         |                          |
| Designers | No analysis                  |                         |                          |
| Manufrs   | 44.2                         | 6                       | 87.9*                    |
| Year 1    | 31.3                         | 7                       | 69.7                     |
| Year 2    | 33.6                         | 7                       | 79.8                     |
| Year 3    | 27.4                         | 8                       | 78.0                     |
| Years 4+5 | 29.9                         | 8                       | 82.3                     |
| Leics     | 26.2                         | 9                       | 75.9                     |
| Teesside  | 27.7                         | 8                       | 72.1                     |
| London    | 28.9                         | 7                       | 73.5                     |

REAL

|           |      |   |       |
|-----------|------|---|-------|
| Students  | 27.3 | 8 | 67.6  |
| Lecturers | 51.5 | 6 | 88.6* |
| Designers | 41.8 | 6 | 76.3* |
| Manufrs   | 40.6 | 6 | 90.7* |
| Year 1    | 26.3 | 7 | 70.1  |
| Year 2    | 28.4 | 8 | 79.8  |
| Year 3    | 27.1 | 8 | 79.4  |
| Years 4+5 | 38.5 | 7 | 81.8* |
| Leics     | 36.0 | 7 | 74.0* |
| Teesside  | 23.5 | 8 | 72.7  |
| London    | 26.0 | 9 | 79.3  |

\* Associated with significant Eigenvalues cited in Appendix VI



## 6.9 Summary

The instruments used in the experimental part of the study were described and so far as the Survey of Values, the Pattern Recognition Test and the Eysenck Personality Questionnaire were concerned, reference was made to the more detailed approach in Chapter 11.

Preliminary analyses using the Survey of Design involved firstly the "Agree" responses, that is scores 5 and 6, and thus the different priorities accorded by the different Status subgroups to questions in the Survey. The absolute priority for IDEAL and REAL was examined and also the distance between IDEAL and REAL. Differences emerged between the patterns of Polytechnic, Designer and Manufacturer status subgroups.

Further analysis involved intercorrelations between questions in the Survey of Design. Examination of the correlation matrix indicated that there were differences between Polytechnics, between status subgroups, and between Years.

A Principal Components Analysis indicated that differences between status subgroups did exist but the results of this analysis were difficult to interpret and could be better accomplished by methods described in chapters 7,8,9, and 10.

## CHAPTER 7

### SURVEY OF DESIGN - SMALLEST SPACE ANALYSIS

#### 7.1 Introduction

Following on the examinations of differences and correlations set forth in Chapter 6 the focus of the study changed to that of an overview of the categories as detailed in 7.2. Global analysis of the data from the Survey of Design was begun by subjecting it to a Smallest Space Analysis SSA1 from the Guttman-Lingoes series (Lingoes 1973). To perform this analysis the data were changed to binary form, that is coded above or below the median for each variable. This is recommended for both SSA1 and MSA1 programs. For further details of this program together with schemas of the output diagrams for subsamples see Appendix VI.

In general terms the SSA1 program maps variables in their relation one to the other and in so doing it is possible to detect clusters or groupings between the variables.

In more technical terms, the SSA1 maps the similarities between the variables. It is possible to produce maps in n dimensions but difficulties are rapidly encountered in interpreting more than three dimensional output. For practical reasons therefore the SSA1 was set to produce three dimensions, but in fact the three dimensional output merely confirmed what could be obtained from the two dimensional. Discussion in the rest of the chapter relates therefore to the latter.

#### 7.2 Hypotheses

Following on the Pilot Survey it was hypothesised that responses to the Design Survey would reveal concepts which fell into the following broad categories:

Higher Order Abilities H

Presentational Skills P

Knowledge & Knowhow K

Attitudes at Work A

Values V



### 7.3 Samples

The main aim at this stage was to confirm that these categories still held good and to examine differences between subgroups by means of SSA analyses.

These SSA1's were performed successively for IDEAL and REAL for the following groups:

1. Complete sample
2. Educational Institutions
3. Status groups - Students, Lecturers, Designers, Manufacturers
4. Student Years

In the main text of the study SSA1 computer plots and associated schematic item diagrams for the Complete sample are inserted. Schematic SSA diagrams for Polytechnics and for Designers and Manufacturers follow, accompanied by a brief discussion.

### 7.4 Complete Sample - IDEAL

Diagram12 is an example of computer output for the SSA1 program in the Guttman- Lingo series, annotated to show actual questions presented, and with partition lines between the domains added.

Diagram13 shows schematically separate domains which correspond to the a priori categories postulated in Sections 5.6 and 7.2. It is to be noted that Values take on a central position and that the categories seem to be clear and discrete. To judge from this two dimensional map the IDEAL conceptual model would seem to be relatively simple and uncluttered

#### 7.4.1 Conclusions

The two dimensional map gives a simple and understandable version of the conceptual model and would tend to confirm the original conceptual categories. Similar discrete domains are found in the three dimensional projections.



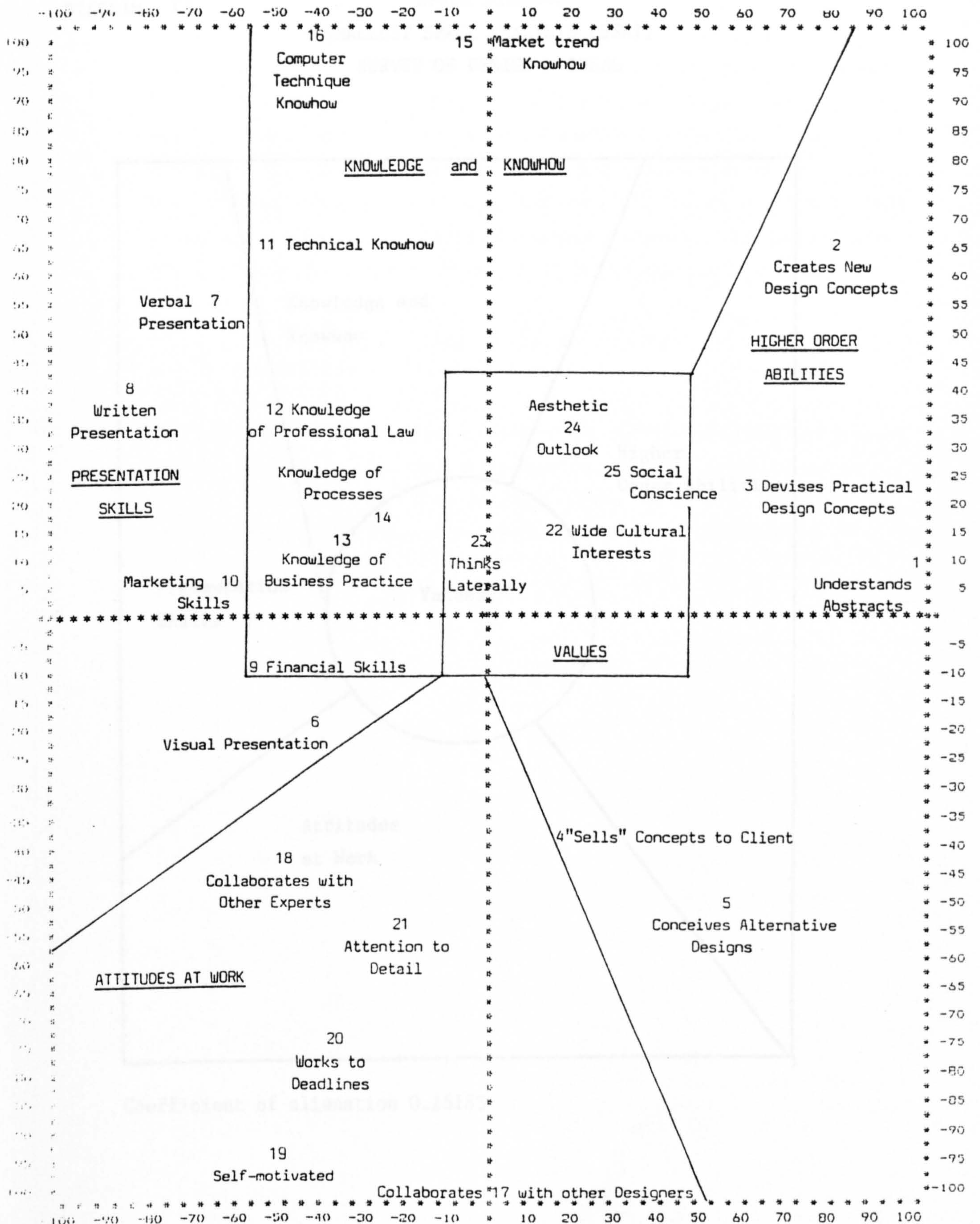
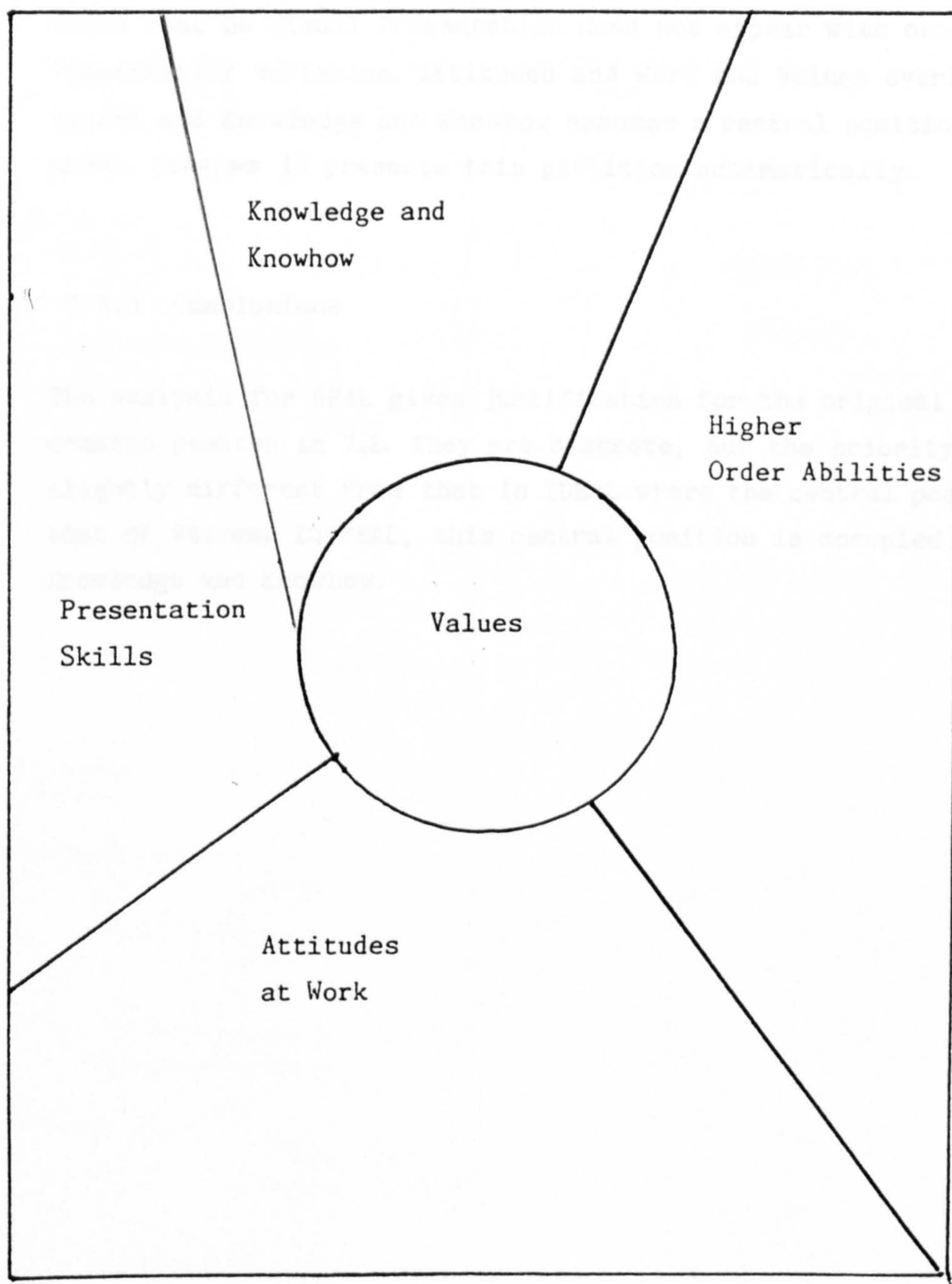




DIAGRAM 13

SPACE DIAGRAM  
SMALLEST SPACE ANALYSIS (SSA1)  
SURVEY OF DESIGN - IDEAL



Coefficient of alienation 0.16185

## 7.5 Complete Sample - REAL

The computer output at Diagram 14 is again annotated with the questions of the Survey of Values. It is not quite so clear as the IDEAL, but clear partitions are possible between Higher Order Abilities, Knowledge & Knowhow and Presentation Skills. It is to be noted that Q6 Visual Presentation does not appear with other Presentation variables. Attitudes and Work and Values overlap to some extent and Knowledge and Knowhow assumes a central position in this model. Diagram 15 presents this partition schematically.

### 7.5.1 Conclusions

The analysis for REAL gives justification for the original conceptual domains posited in 7.2. They are discrete, but the priority seems slightly different from that in IDEAL where the central position was that of Values. In REAL, this central position is occupied by Knowledge and Knowhow.



DIAGRAM 14

COMPUTER PLOT SSA 1  
SURVEY OF DESIGN - REAL

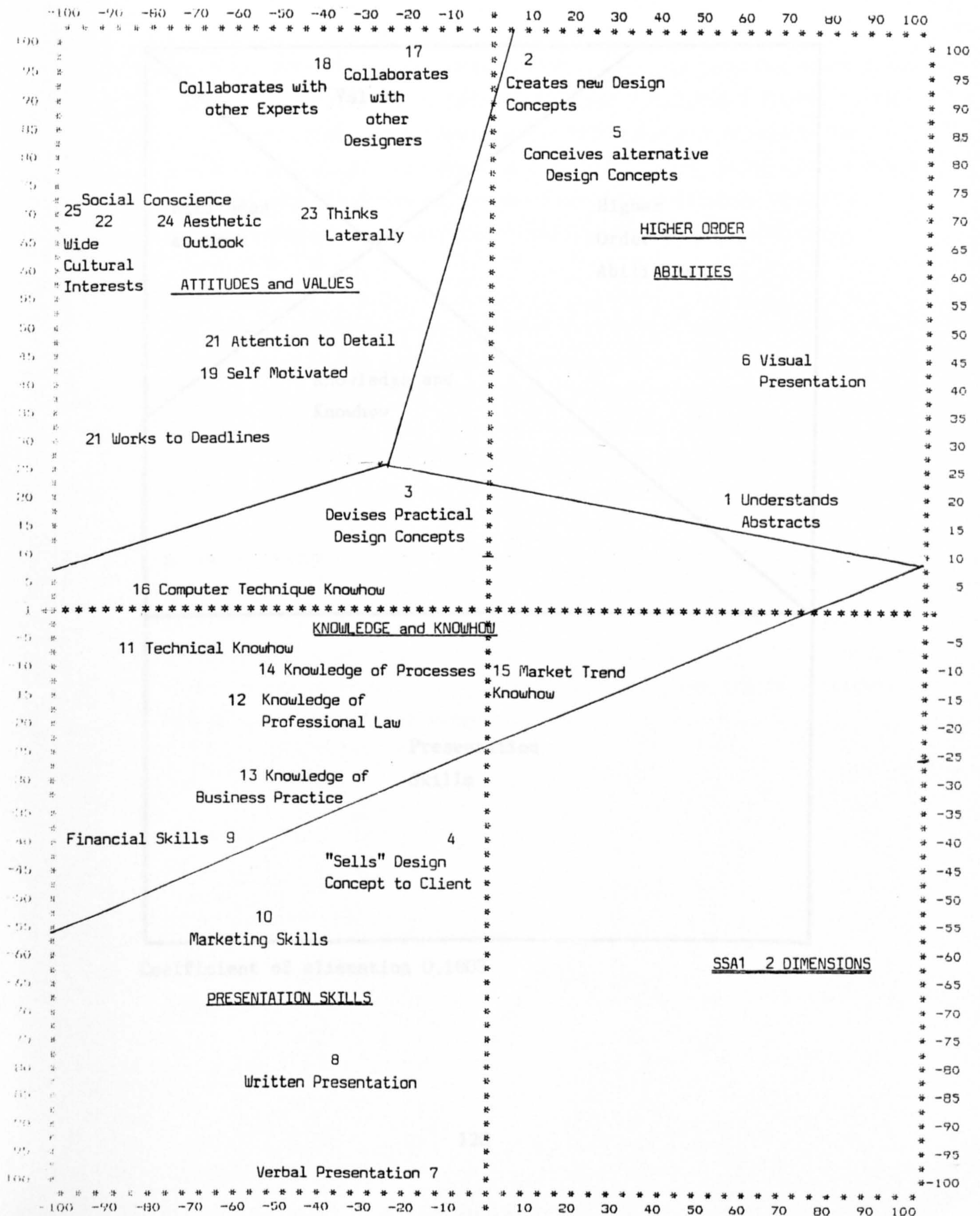
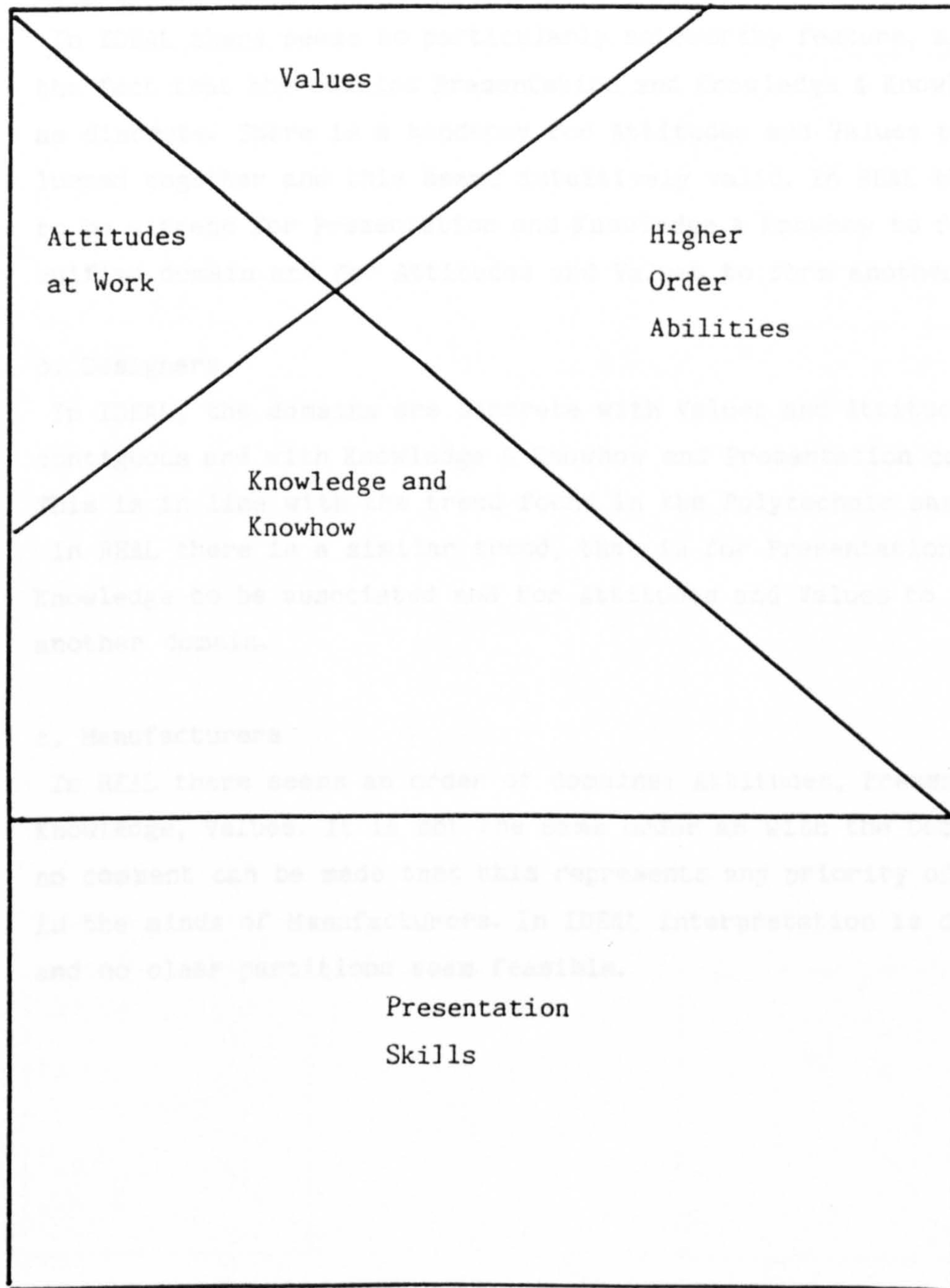




DIAGRAM 15

SPACE DIAGRAM  
SMALLEST SPACE ANALYSIS (SSA1)  
SURVEY OF DESIGN - REAL



Coefficient of alienation 0.1803



## 7.6 Status subgroups

Schematic diagrams 16 and 17 are derived from SSA1 analyses of status sub-groups.

### a. Students and Lecturers

In IDEAL there seems no particularly noteworthy feature, apart from the fact that the domains Presentation and Knowledge & Knowhow show as discrete. There is a tendency for Attitudes and Values to be lumped together and this seems intuitively valid. In REAL there seems to be a trend for Presentation and Knowledge & Knowhow to form a unified domain and for Attitudes and Values to form another.

### b. Designers

In IDEAL, the domains are discrete with Values and Attitudes contiguous and with Knowledge & Knowhow and Presentation contiguous. This is in line with the trend found in the Polytechnic sample.

In REAL there is a similar trend, that is for Presentation and Knowledge to be associated and for Attitudes and Values to form another domain.

### c. Manufacturers

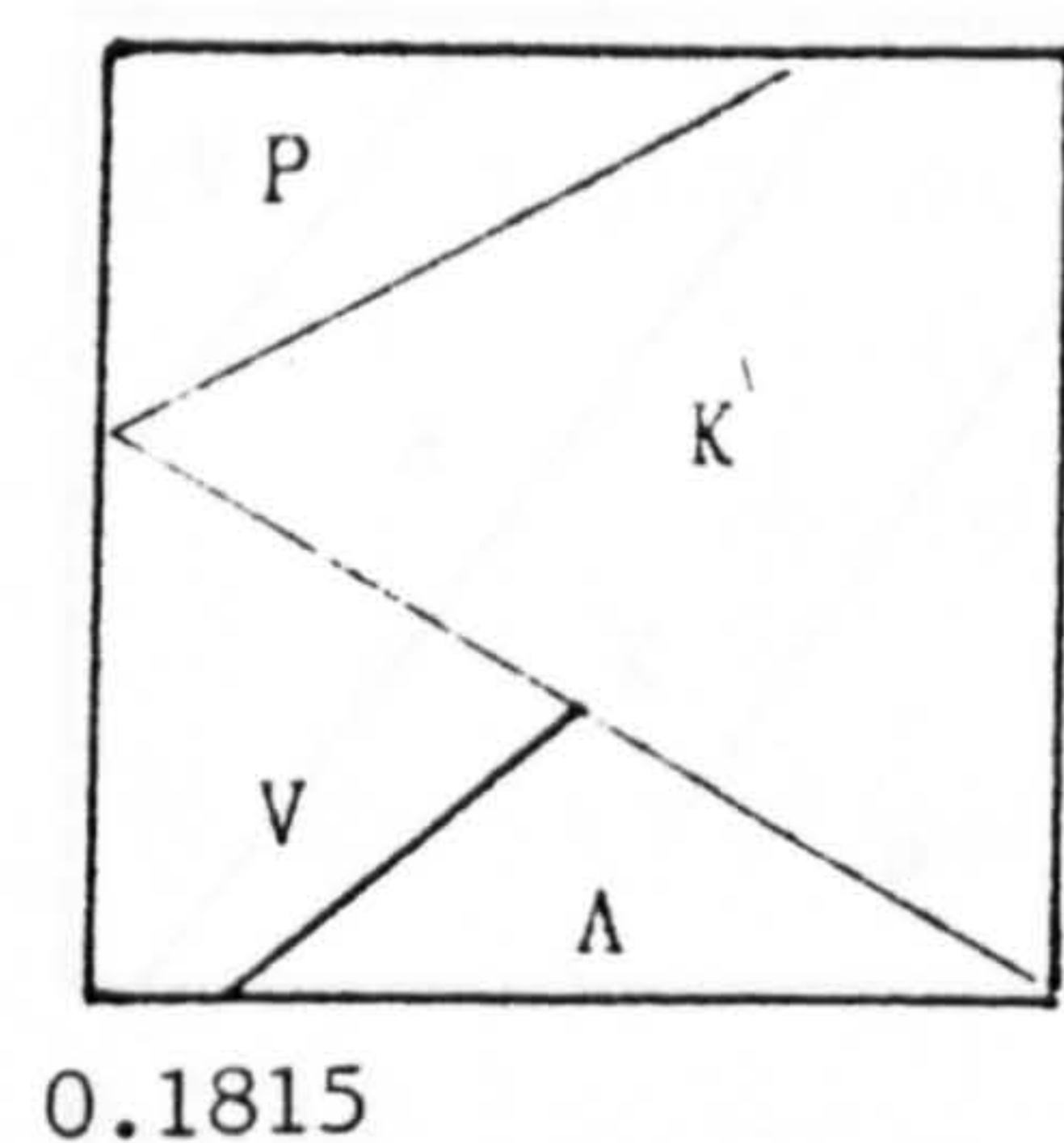
In REAL there seems an order of domains: Attitudes, Presentation, Knowledge, Values. It is not the same order as with the Designers and no comment can be made that this represents any priority of concepts in the minds of Manufacturers. In IDEAL interpretation is difficult and no clear partitions seem feasible.

DIAGRAM 16

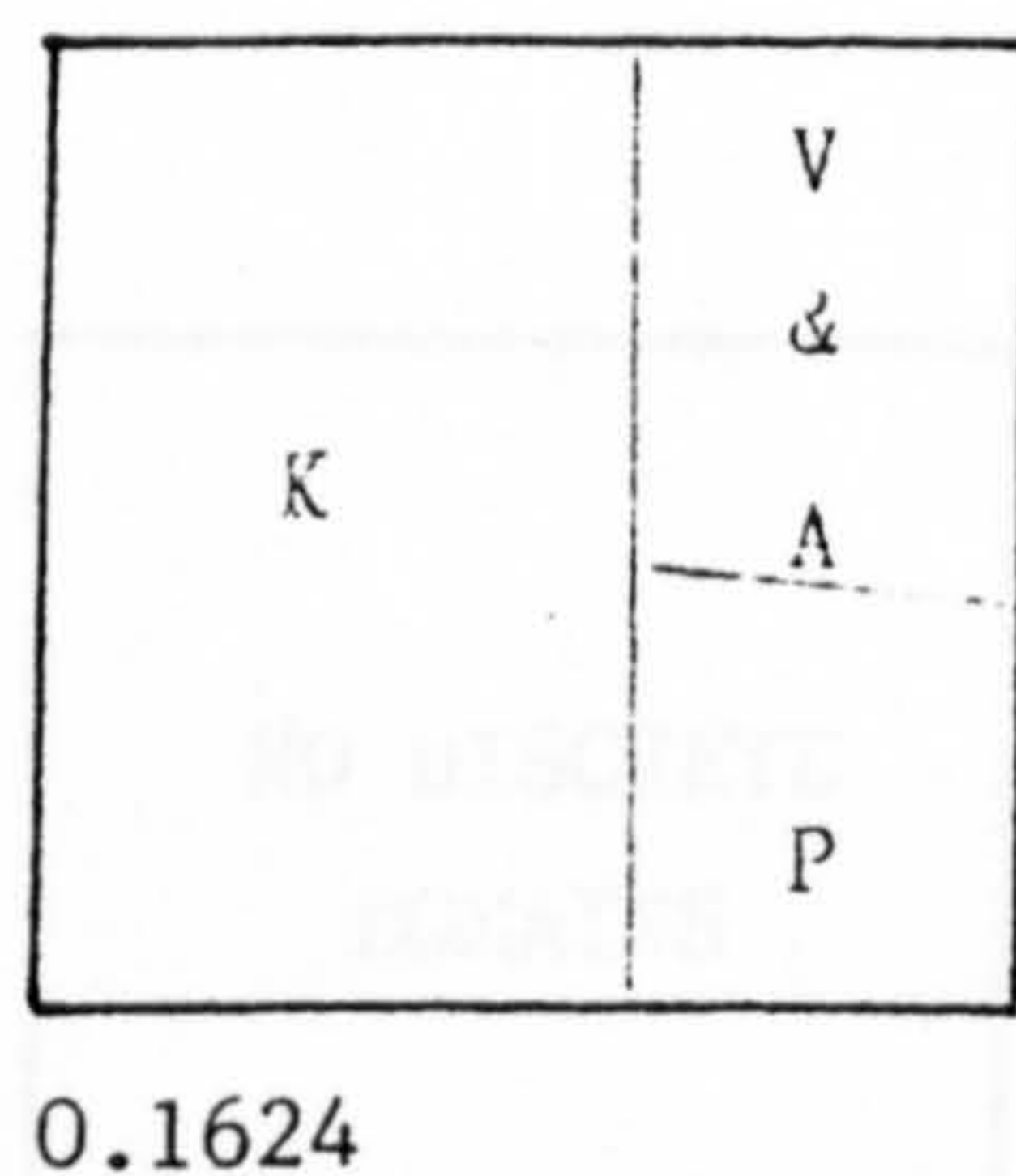
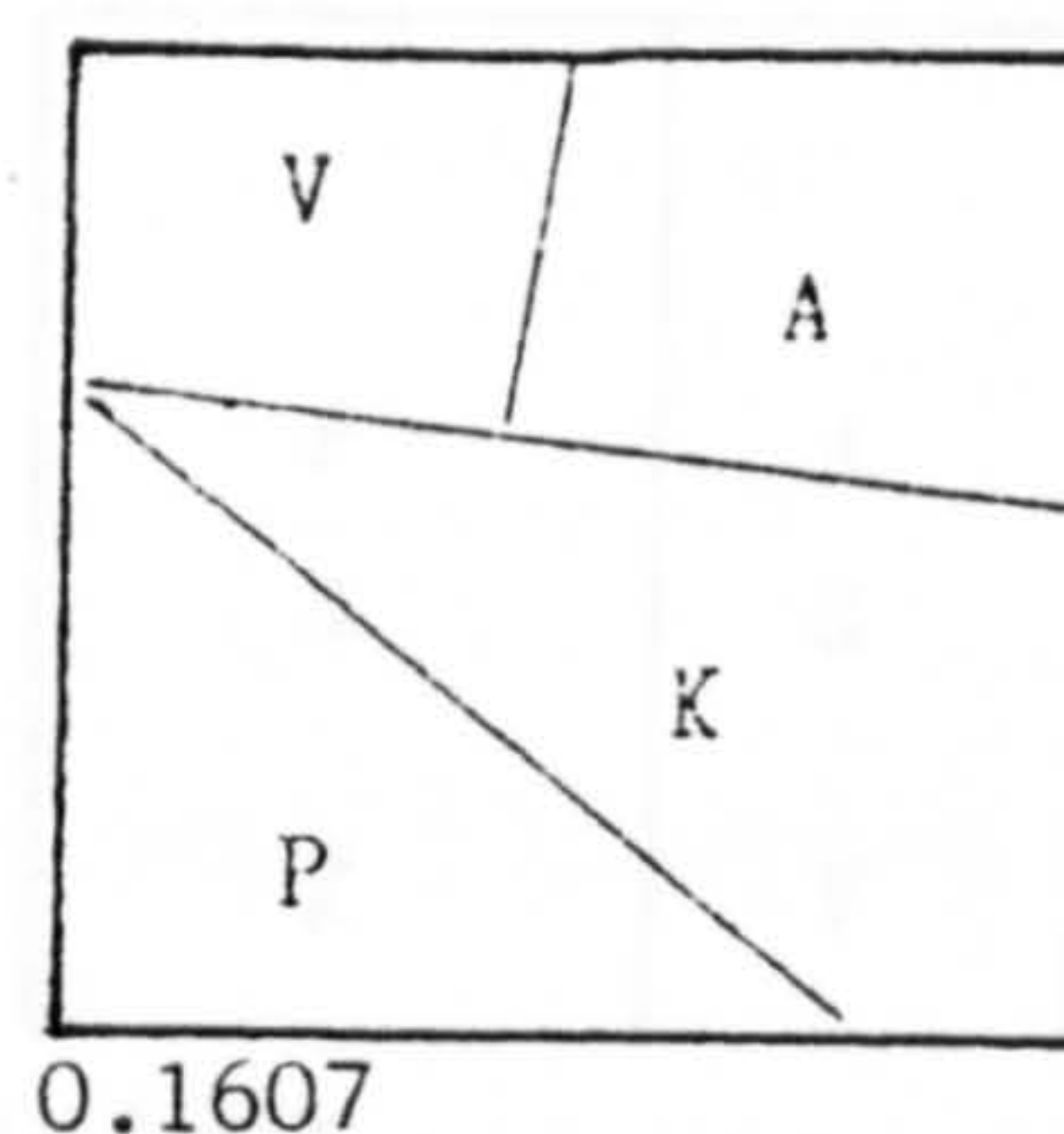
SMALLEST SPACE ANALYSIS  
SCHEMATIC DIAGRAMS TO SHOW  
PARTITION INTO CONCEPTUAL DOMAINS  
STUDENTS AND LECTURERS  
INSTITUTIONS

IDEAL

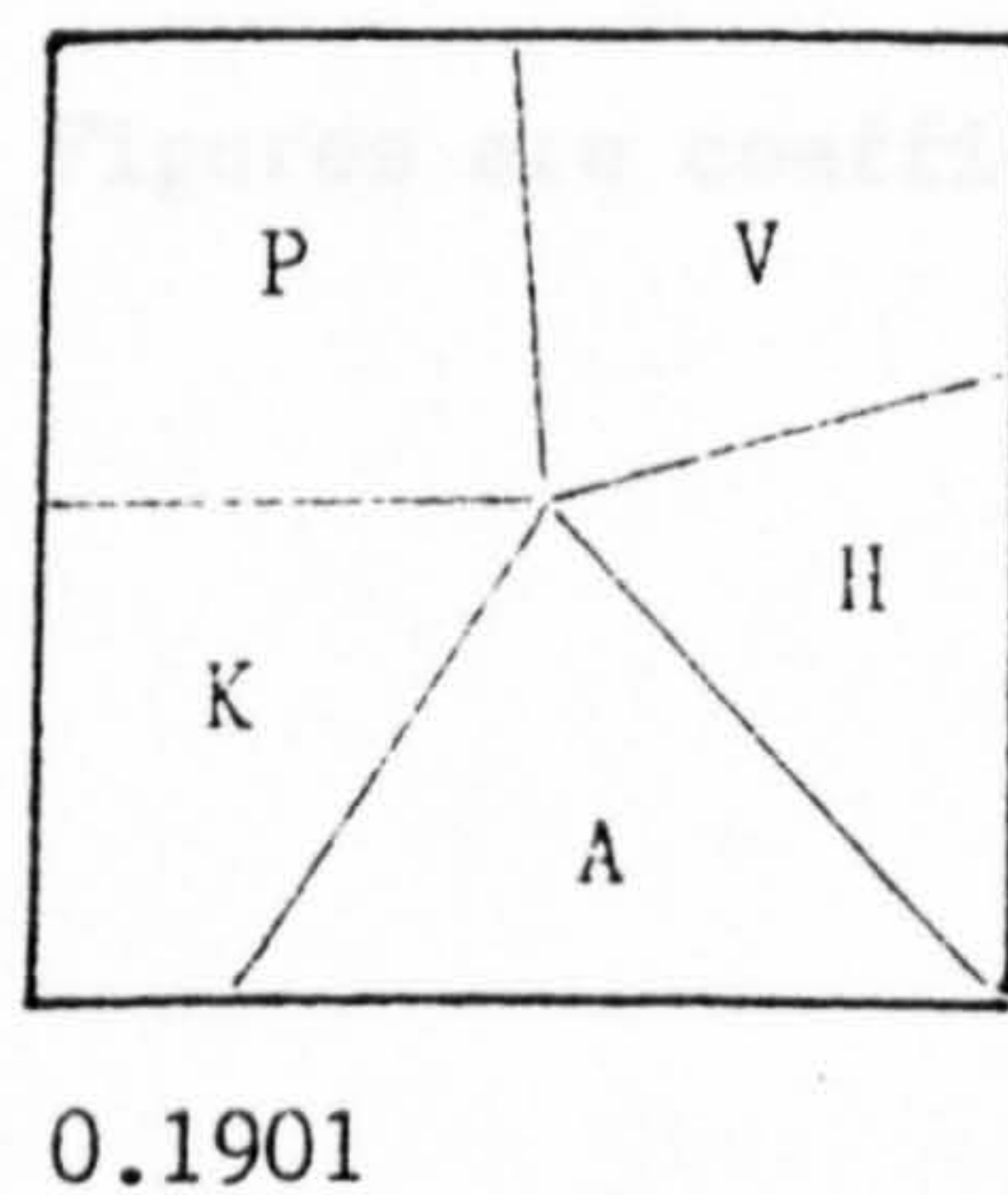
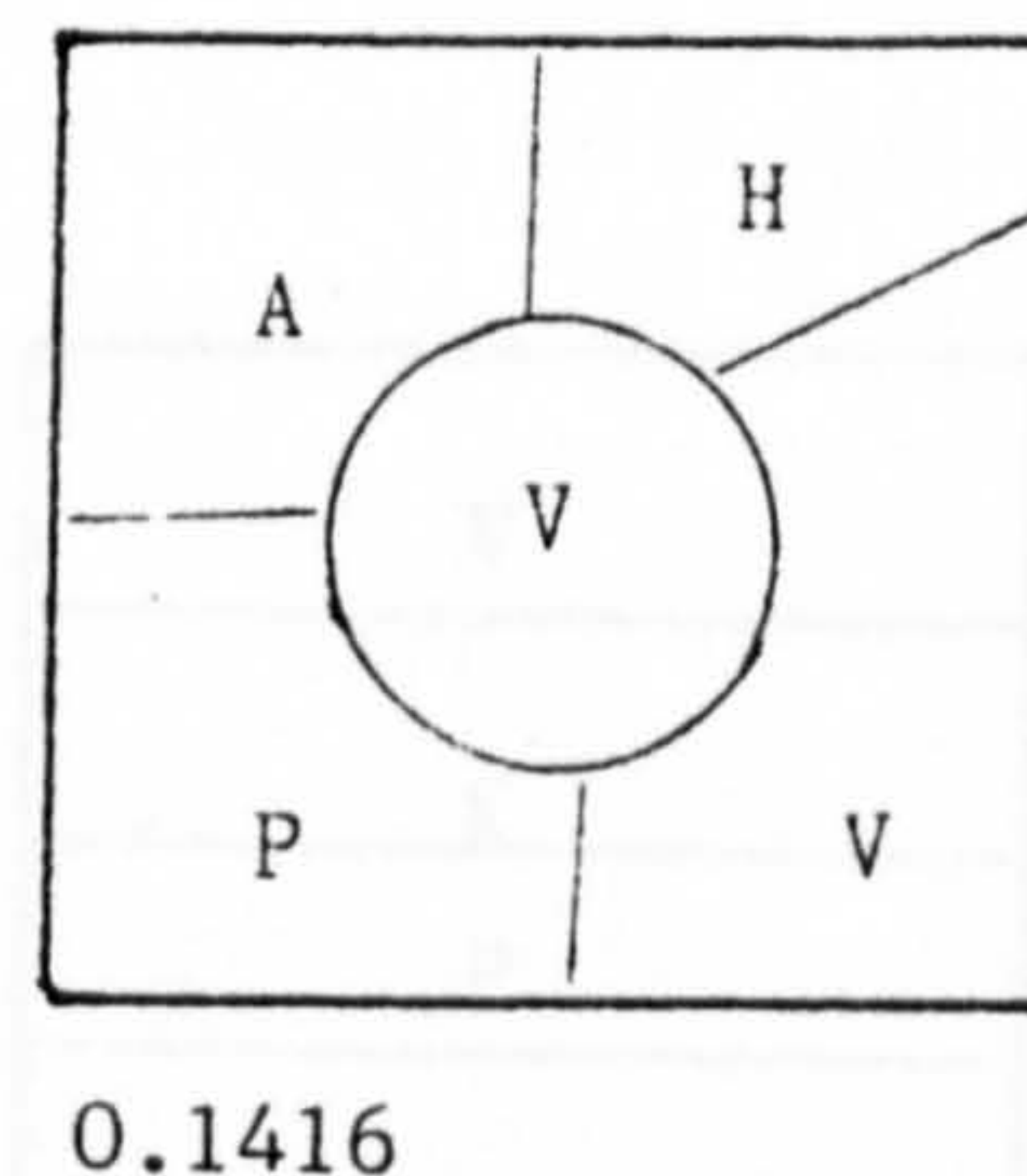
REAL



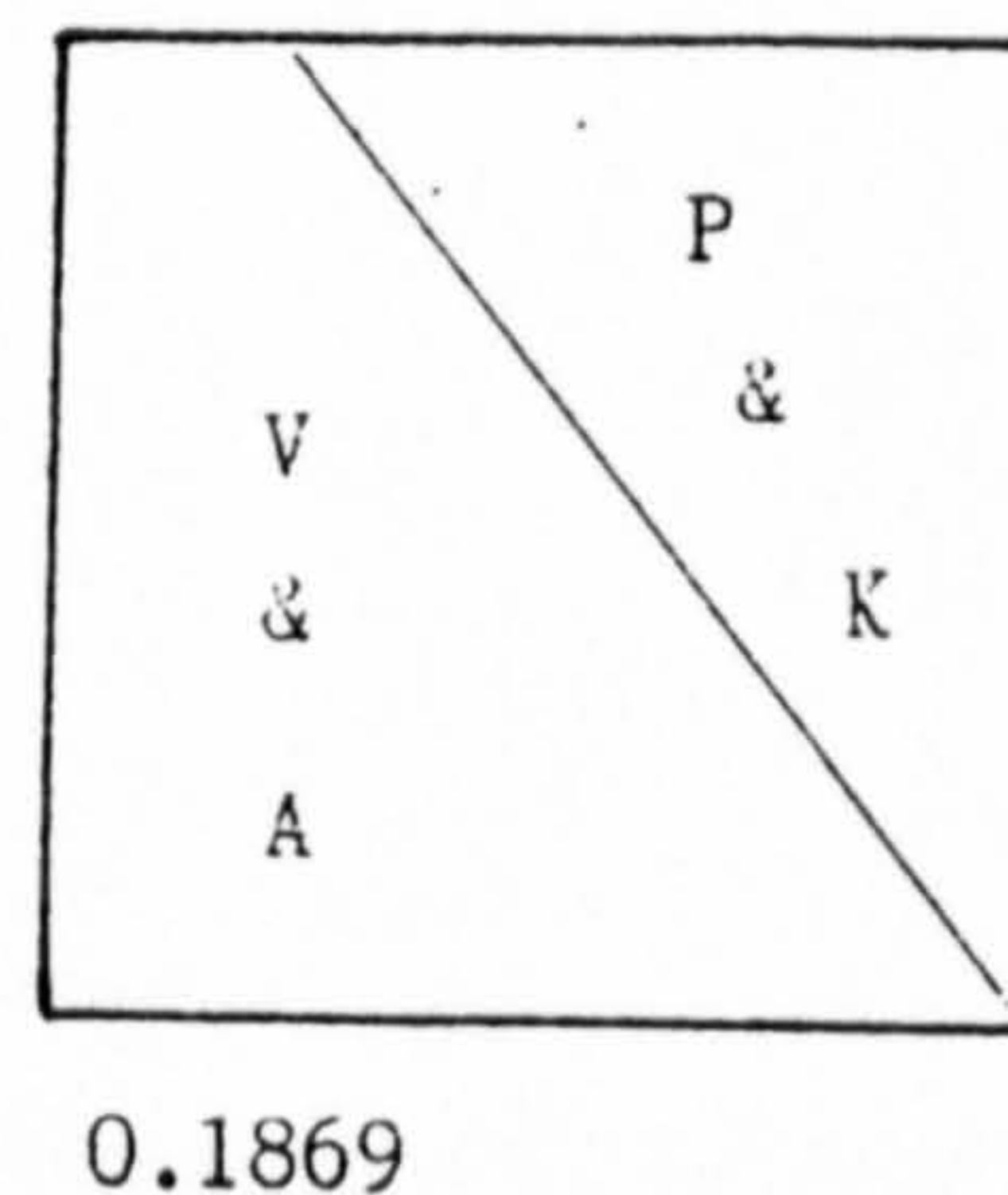
LEICESTER



TEESSIDE



CENTRAL SCHOOL  
LONDON

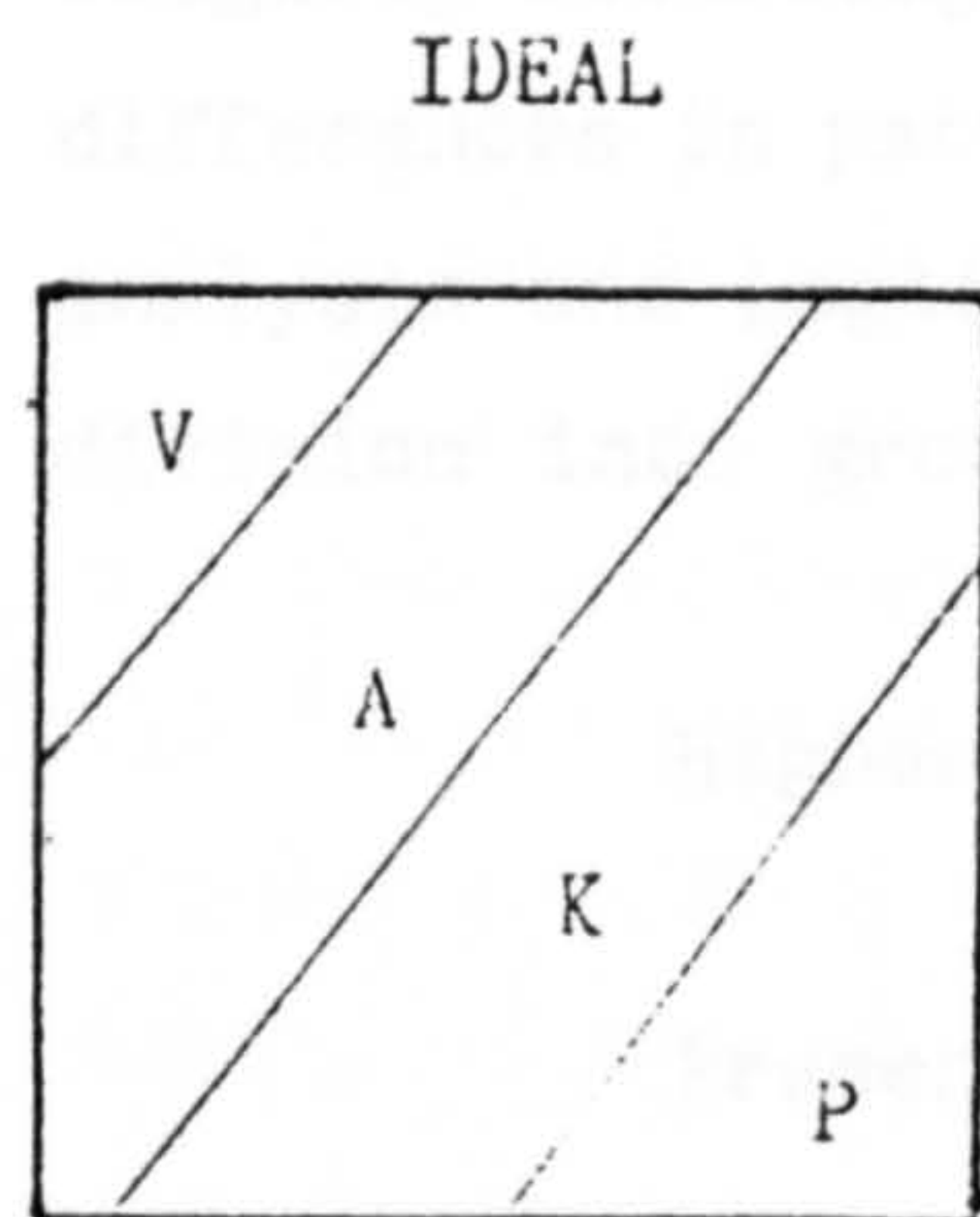


Figures are coefficients of alienation



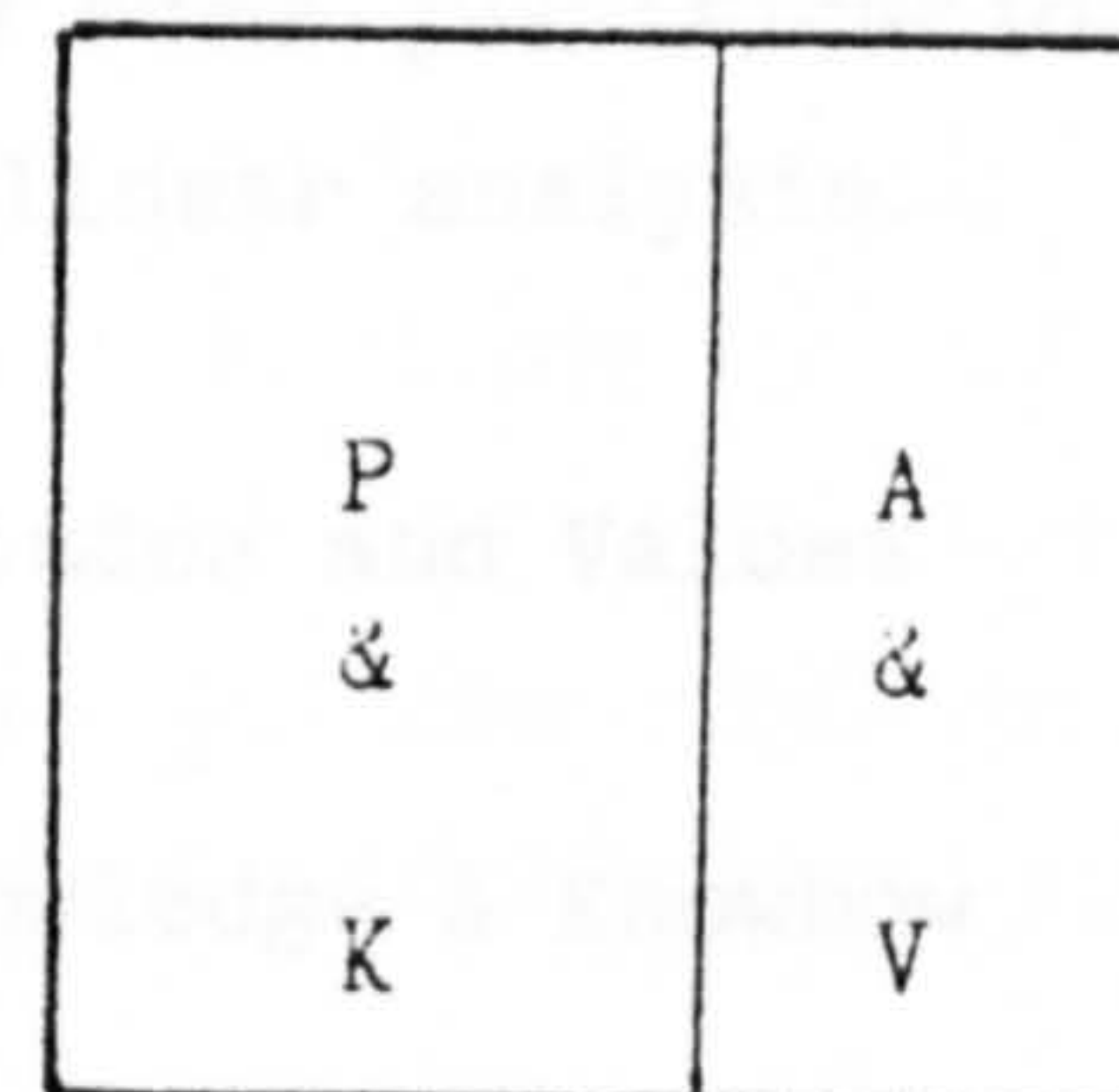
DIAGRAM 17

SMALLEST SPACE ANALYSIS  
SCHEMATIC DIAGRAMS TO SHOW  
PARTITION INTO CONCEPTUAL DOMAINS  
DESIGNERS AND MANUFACTURERS

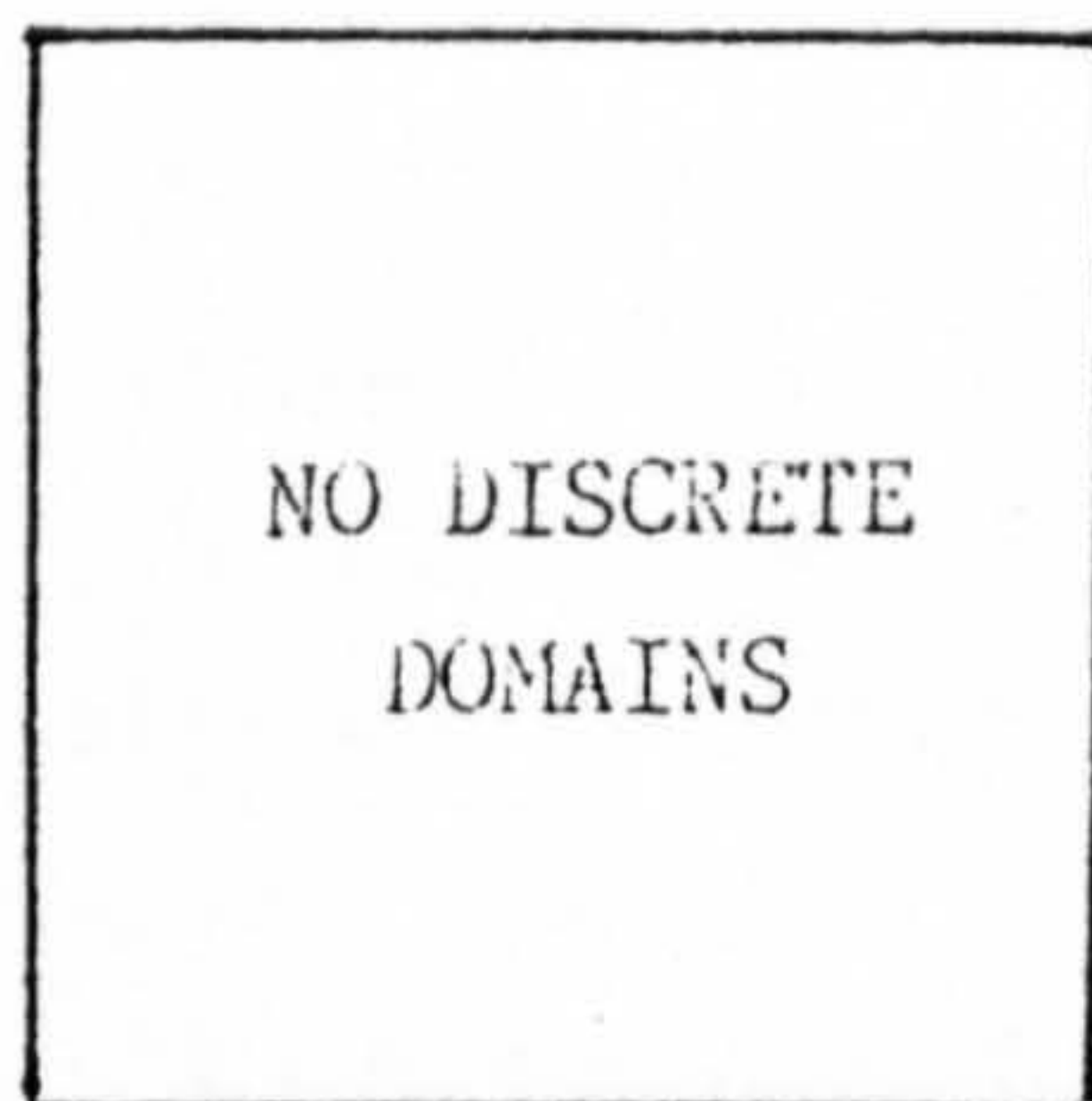


0.1712

DESIGNERS

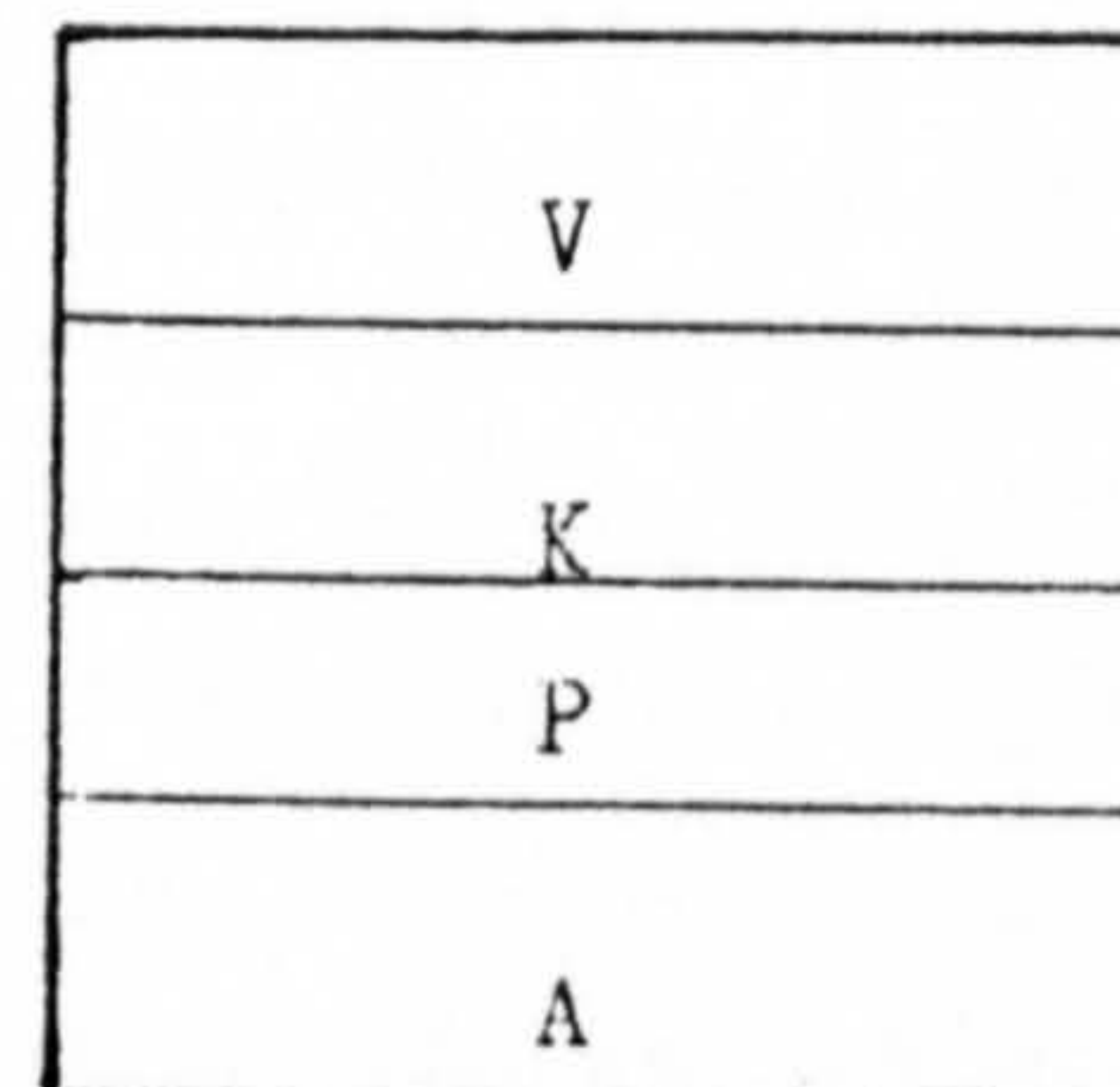


0.1803



0.3424

MANUFACTURERS



0.1718

Figures are coefficients of alienation

## 7.7 Summary

The Survey of Design, analysed by SSA in the same way as the Pilot Survey, reveals the same conceptual divisions. These divisions vary slightly according to the subgroup being examined and it is these differences in pattern which will be explored further by means of MSA analysis and Loglinear analysis. There is some justification for the division into groups, adopted in the Loglinear analysis.

Higher Order Abilities, Attitudes and Values  
and  
Presentational Skills and Knowledge & Knowhow



## CHAPTER 8

### SURVEY OF DESIGN - MULTIDIMENSIONAL SCALOGRAM ANALYSIS

#### 8.1 Introduction

This chapter introduces Multidimensional Scalogram Analysis and some of its basic concepts. Data from the Main Survey of Design is analysed and mismatches are noted between two basic groups of people: the Commercial or Non-Poly population and the Educational or Poly population. From the 25 items in the IDEAL and the REAL parts of the survey more detailed conclusions are derived about mismatches.

#### 8.2 Multidimensional Scalogram Analysis

The MSA1 program from the Guttman-Lingoes series (Lingoes 1973) evaluates the similarities between the sets of responses put forward by individuals in terms of the correlations between these responses. The similarities between these sets (or "structuples" in MSA terminology) are portrayed in an analogue manner on a "Space Diagram". This shows individual structuples in relation to the one with all the others, and plots similar structuples closer than less similar structuples. Proximity then is a function of similarity.

The Space Diagram plots the cumulated result of the Scalogram analysis and this is followed by separate plots representing the separate variables which have gone to make up the complete structuple.

The plots for the variables, the "Item Diagram", maintain the topology of the Space diagram and it is thus possible:

- a. To detect overall similarity within groups of individuals who share some common qualities - they may be all Designers for example.
- b. To detect overall dissimilarities between groups - so-called "partitions".
- c. To analyse in greater detail the actual responses for each variable.

The MSA1 program allows for a maximum of 99 individuals and it was therefore necessary to take a random 50% sample from the total population of 204 individuals.

The Space and Item diagrams simplify a mass of complex data while still keeping inviolate the details of the individual's complete set of scores, the "structuple", which can be retrieved and evaluated. It is possible therefore to identify the individual and see him in relation to others.

### 8.3 Research involving Multidimensional Scalogram Analysis

Research covering a wide range of areas and issue has made use of MSA1 techniques in order to come to grips with concepts used by respondents.

For example, Bloombaum (1968) has employed it to investigate conditions underlying Race Riots.

Guttman & Kahneman (1971) to study  
Sex and age differences in conceptual tasks.

Burnstein (Burnstein et al 1972) have used MSA to construct models in Psychotherapy and Psychoanalysis.

Zevulun (1979) use this techniques in the evaluation by soldiers of their military commanders.

Brown (1980) has investigated the role of motivation in moving and buying a house.

Groat (1982) in a more linguistic approach, investigates the way architects use stylistic terms.

Frost & Canter (1982) are concerned with the corporate image of banks.

Guttman (1984), the doyen of the MSA approach has investigated the classification of cetacea: whales, porpoises & dolphins



Grainger (1980) has examined differing concepts held by architects and clients as to the functions that buildings should perform. This study is of special interest in that it is one of the few with positive relevance to the present study.

Following the tenets of Facet Analysis, Grainger studies broad conceptual structure on the part of those participating in the design and use of a fire station. He relies on MSA and the interpretations of the partitions revealed. In so doing he identifies two main divisions - facets in his terminology - related to design organisation and design involvement.

There are thus parallels with the present study, but there are also differences:

a. The present study is more broadly based. Whereas Grainger dealt with a specific building and a limited number of participants (N=18), we are concerned with Industrial Design per se. The numbers of people involved are thus potentially much larger and have an effect on the choice of analysis.

b. The present study does use both SSA and MSA but as devices to explore the potential categories and concepts in use. It goes on to use Loglinear techniques and delineate the internal structure of conceptual models. This combination of statistical techniques enables more detailed findings to be made and moreover it is generalisable for the study of other groups and professional activity.

MSA1 techniques and applications are discussed in detail by Brown & Sime in Shepherd & Watson (1982)

#### 8.4. Diagrams and their evaluation

The Space Diagram and pertaining Item Diagrams are identical in lay out or topology and the aim is to distinguish certain domains or zones occupied by plots of homogeneous or near homogeneous description.

A method of evaluating the zones which have been delineated is suggested by Shalit (1977) who says that to obtain a clearer indication of the efficiency of zoning the following two indexes be applied:

a. Index of Selectivity, or the exclusivity of the partitioned zone for a category which we would like to isolate (referred to as the target category). This is expressed as the ratio of the total number of cases in the zone (N) to the number of the target category within this zone (X).

$$\text{Selectivity} = X/N$$

b. Index of Sensitivity, or the efficiency of the partitioning in enclosing all members of the target category within the zone. This is expressed as the ratio of the total number of cases of the target category on the entire diagram (Y) to the number of cases of the target category within the zone (X)

$$\text{Sensitivity} = X/Y$$

Shalit makes the point that it is up to the researcher to draw the zones and show the emerging clusters. He says that it may be felt "unscientific" inasmuch that there are no rigid rules which dictate the precise point where the lines should be drawn. However he maintains that the efficiency of differentiation, as indicated by the sensitivity and selectivity score is also very clear. The usual statistical comparison between distributions involve comparing means and standard deviations, both of which are ways of condensing much information in two numbers. The MSA leaves the data in its raw state, only regrouped for each to compare as he will.



## 8.5 The Ideal Model

The original raison d'être for the IDEAL mode questions was to provide a forum wherein "acceptable" responses could be made - acceptable, that is, in the sense of "socially conforming".

The IDEAL questions were expected to evoke substantial "agree" responses, since they were derived from interviews, curricular statements and other published material.

In the event, however the responses were were not so homogeneous nor so conformist as had been surmised and a fair amount of variation was revealed.

### 8.5.1 Space Diagram - IDEAL

Diagram 18 shows a partition into two principal domains:

Domain A - Commercial  
as opposed to  
Domain B - Educational.

It is possible to differentiate A into:

A1 which selects out effectively Manufacturers and Designers and may be called "Commercial Hard-core"

and

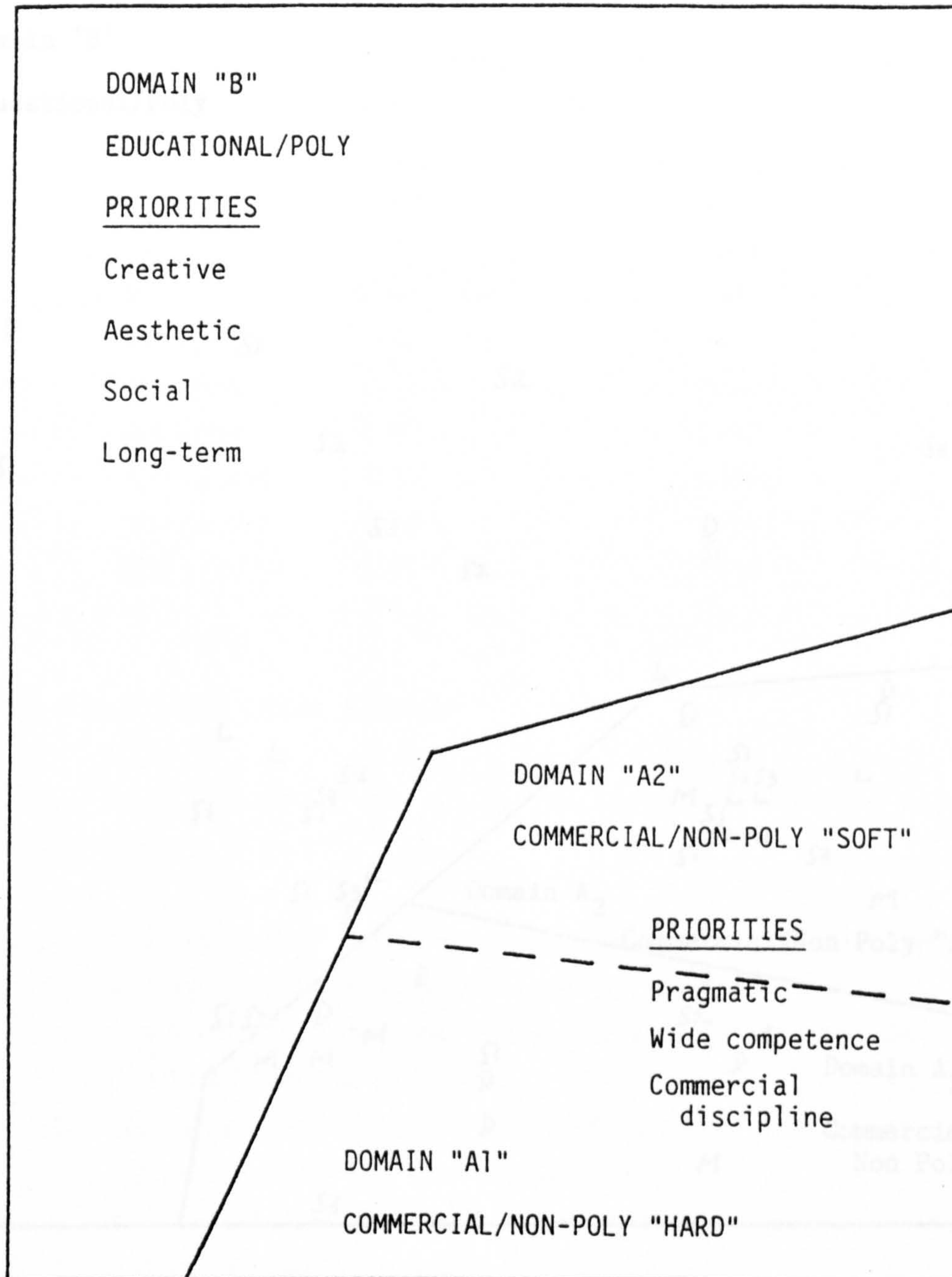
A2 which in addition contains some Lecturers and Students and may be called "Commercial Soft-core".

DIAGRAM 18

SPACE DIAGRAM

MULTIDIMENSIONAL SCALOGRAM ANALYSIS (MSA1)

SURVEY OF DESIGN - IDEAL



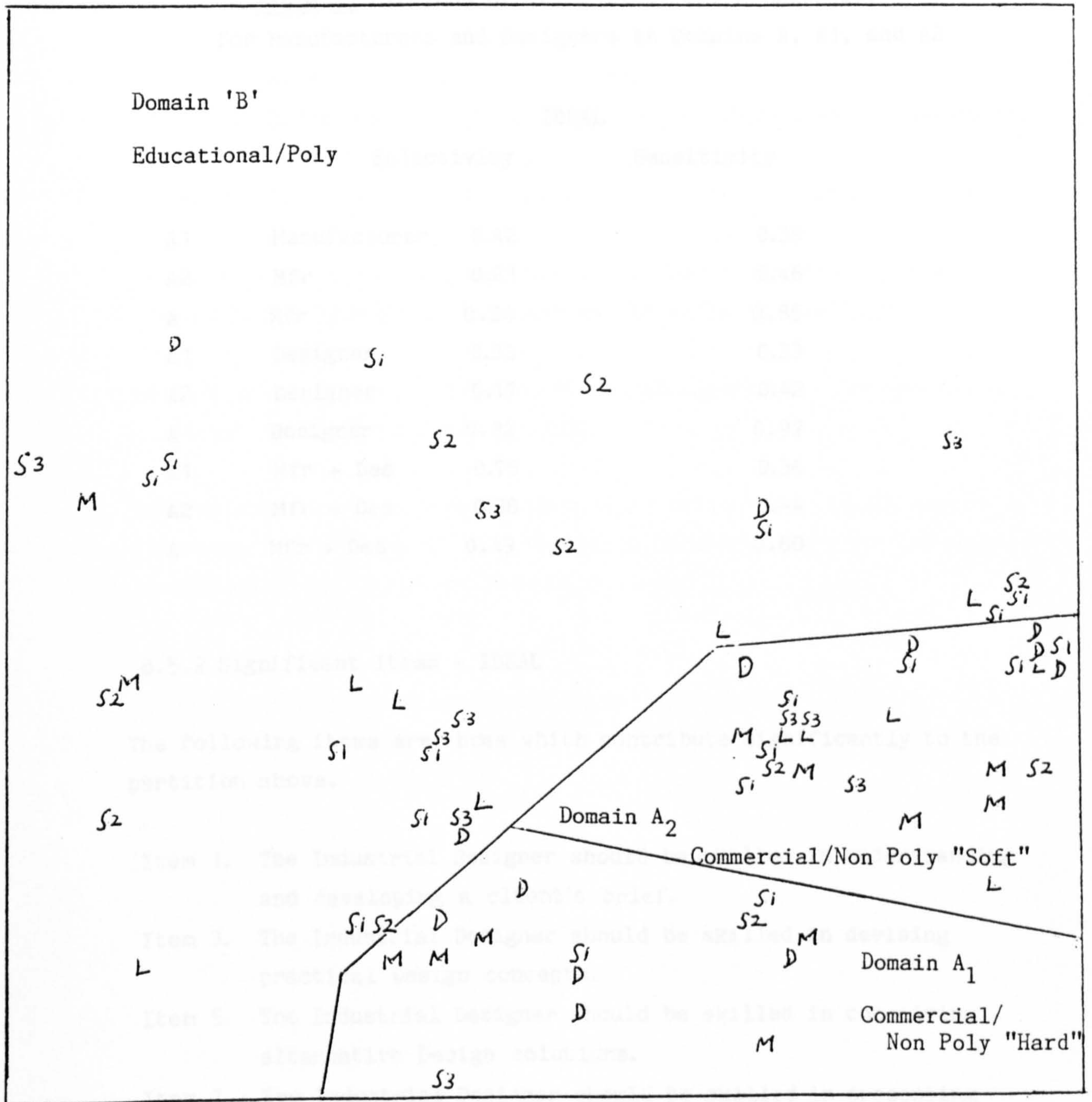
Coefficient of contiguity 0.86185

Legend: S1 Student 1st Year  
S2 Student 2nd Year  
S3 Student 3rd Year  
L Lecturer  
D Designer  
M Manufacturer



MULTIDIMENSIONAL SCALOGRAM ANALYSIS (MSA 1)

DISTRIBUTION OF STATUS GROUPS - IDEAL



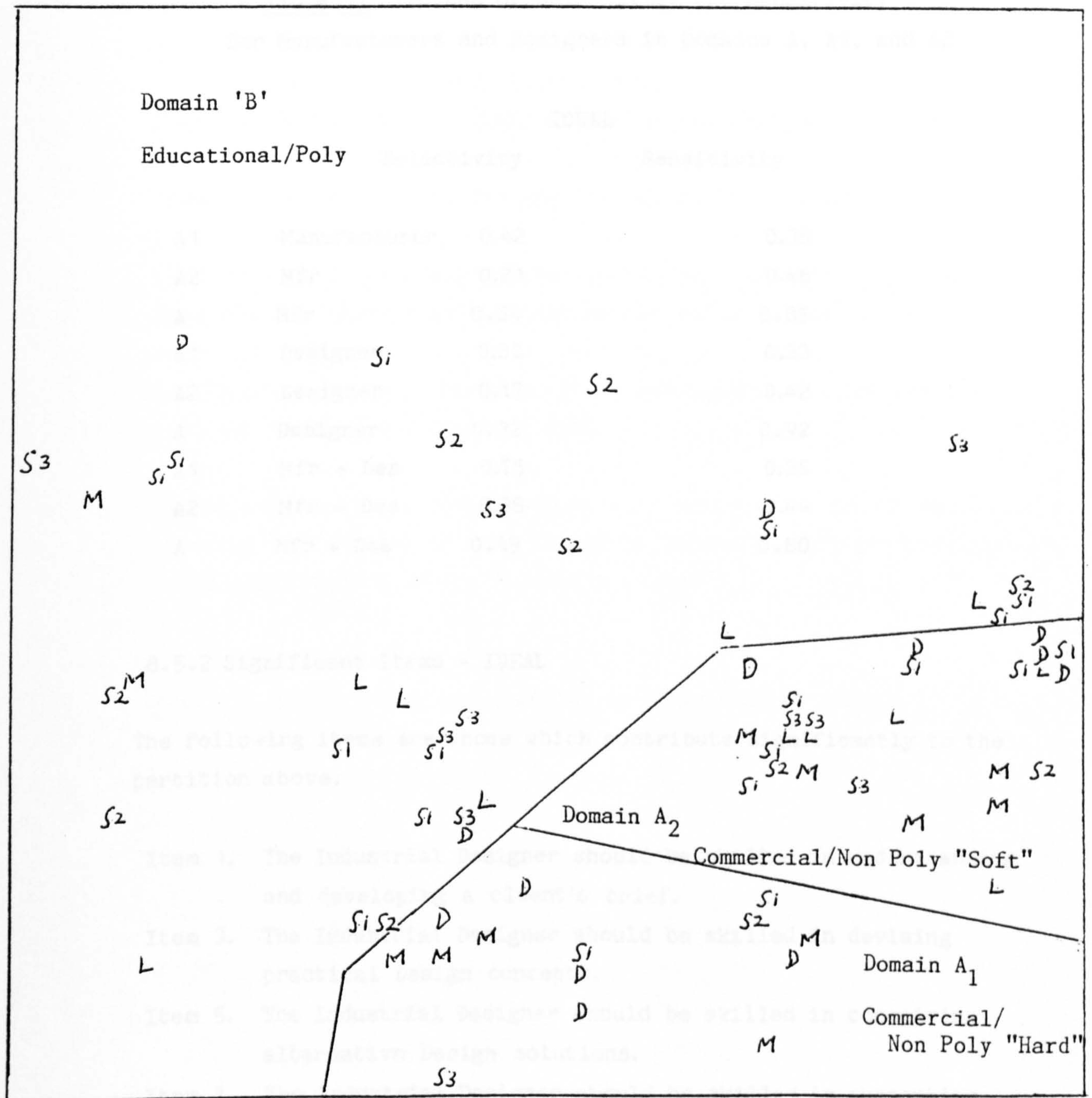
Legend:

- S1 Student 1st Year
- S2 Student 2nd Year
- S3 Student 3rd Year
- L Lecturer
- D Designer
- M Manufacturer



MULTIDIMENSIONAL SCALOGRAM ANALYSIS (MSA 1)

DISTRIBUTION OF STATUS GROUPS - IDEAL



Legend:

|    |                  |
|----|------------------|
| S1 | Student 1st Year |
| S2 | Student 2nd Year |
| S3 | Student 3rd Year |
| L  | Lecturer         |
| D  | Designer         |
| M  | Manufacturer     |



Table 11 gives measures of Selectivity and Sensitivity which justify the partitions mentioned above.

Table 11 Indices of Selectivity and Sensitivity  
for Manufacturers and Designers in Domains A, A1, and A2

|    |              | IDEAL       |             |
|----|--------------|-------------|-------------|
|    |              | Selectivity | Sensitivity |
| A1 | Manufacturer | 0.42        | 0.38        |
| A2 | Mfr          | 0.21        | 0.46        |
| A  | Mfr          | 0.34        | 0.85        |
| A1 | Designer     | 0.33        | 0.33        |
| A2 | Designer     | 0.17        | 0.42        |
| A  | Designer     | 0.22        | 0.92        |
| A1 | Mfr + Des    | 0.75        | 0.36        |
| A2 | Mfr + Des    | 0.38        | 0.44        |
| A  | Mfr + Des    | 0.49        | 0.80        |

#### 8.5.2 Significant Items - IDEAL

The following items are those which contribute significantly to the partition above.

- Item 1. The Industrial Designer should be skilled in understanding and developing a client's brief.
- Item 3. The Industrial Designer should be skilled in devising practical Design concepts.
- Item 5. The Industrial Designer should be skilled in conceiving alternative Design solutions.
- Item 7. The Industrial Designer should be skilled in presenting Design concepts verbally.
- Item 9. The Industrial Designer should be skilled in understanding the financial implications of Design decisions.
- Item 10. The Industrial Designer should be skilled in marketing techniques.
- Item 11. The Industrial Designer should have an understanding of relevant engineering theory and technique.

- Item 14 The Industrial Designer should have an understanding of relevant volume production processes.
- Item 15 The Industrial Designer should have an understanding of current market trends.
- Item 16 The Industrial Designer should have an understanding of relevant computer techniques.
- Item 18 The Industrial Designer should collaborate well with experts from other areas.
- Item 20 The Industrial Designer should work successfully to dead lines.
- Item 21 The Industrial Designer should pay attention to detail.
- Item 23 The Industrial Designer should think laterally.

Details of the Indices of Selectivity and Sensitivity for the above items may be found in Appendix VIII.

Leaving aside results from Items 7,15,23 which refer to A2, the following percentages of individuals in Domain A, that is "Commercial" scored above median in the following items.

Table 11a Percentages above median in "Commercial" - IDEAL

| Item | %  |
|------|----|
| 1    | 66 |
| 3    | 66 |
| 5    | 65 |
| 9    | 77 |
| 10   | 75 |
| 11   | 71 |
| 14   | 77 |
| 15   | 60 |
| 17   | 62 |
| 20   | 68 |
| 21   | 67 |



It is evident that in the Commercial world both Designers and Manufacturers would like to see higher standards in the above areas, and it would seem reasonable to point to a separation of conceptual models focused on these items.

One may set aside the results from Items 7, 15, 23 as not sufficiently clear-cut and mainly derived from the sub-Domain A2. The remaining mismatches may be qualified as Pragmatic - Items 3, 5, 9, 10, 11, 14 and 16; and related to Work - Items 1, 18, 20, 21.

By implication, at least, the Educational world, while not decrying these elements, gives them a lower priority in their conceptual models. This would seem to be in line with the investigation of the Design Council and the DES published as the Hayes Report in 1983, which stressed mismatches especially in the field of market reality.

### 8.6 The REAL model

The Space Diagram may be divided into two domains (see Diagram 20)

Domain A may reasonably be regarded as representing the Commercial/non-Poly group. It contains over 75% of the Manufacturers and 50% of the Designers. There are under 10% of the students and only 2 Lecturers at the interface with B.

Domain B on the other hand may be characterized as the Education/Poly group with 90% of the Students and 70% of the Lecturers.

Details of the Indices of Selectivity and Sensitivity follow in Table 12.

Table 12 Indices of Sensitivity and Selectivity - REAL

| Domain A.            | Selectivity | Sensitivity |
|----------------------|-------------|-------------|
| Manufacturers        | 0.46        | 0.79        |
| Designers            | 0.29        | 0.50        |
| Mfrs & Designers     | 0.75        | 0.54        |
| Domain B.            |             |             |
| Students             | 0.65        | 0.91        |
| Lecturers            | 0.19        | 0.71        |
| Students & Lecturers | 0.76        | 0.88        |

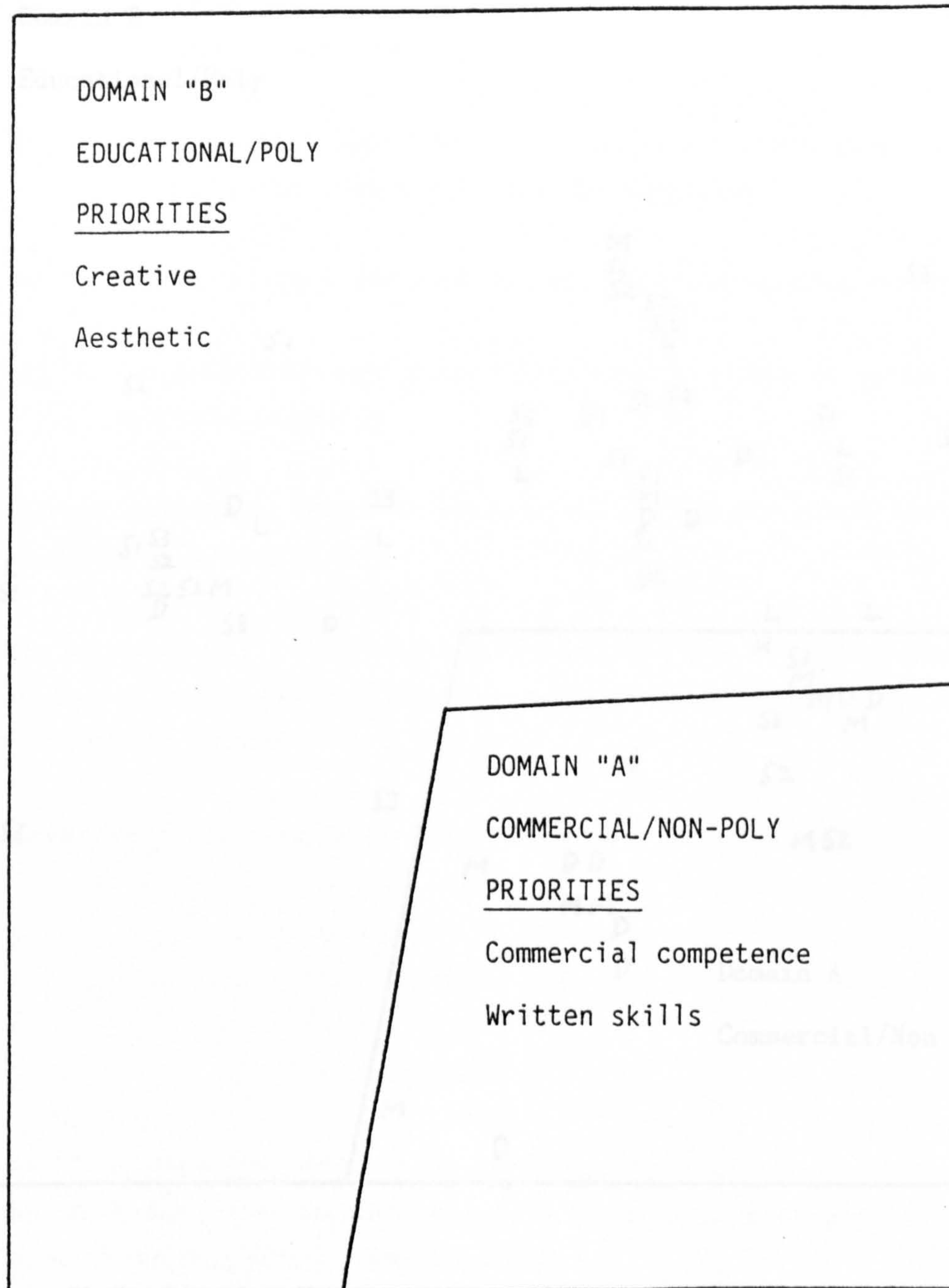


DIAGRAM 20

SPACE DIAGRAM

MULTIDIMENSIONAL SCALOGRAM ANALYSIS (MSA1)

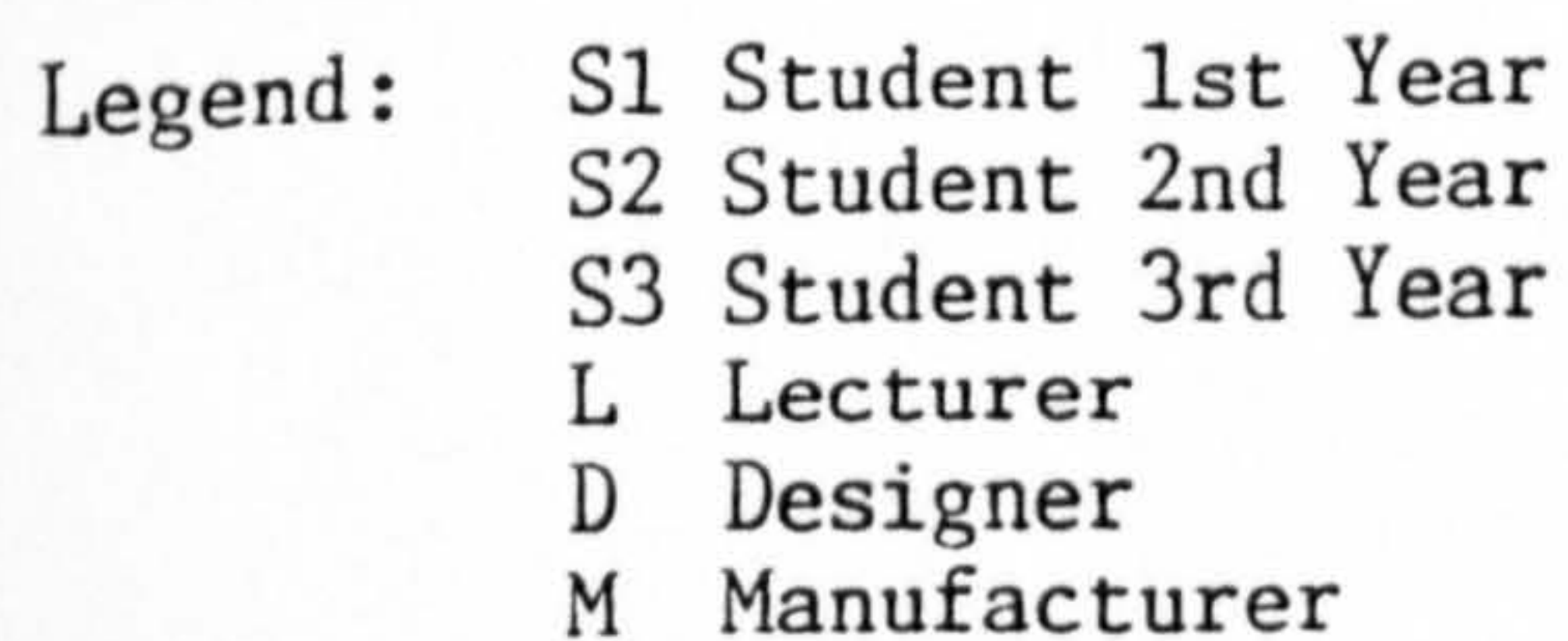
SURVEY OF DESIGN - REAL



Coefficient of contiguity 0.80300

### SPACE DIAGRAM

## DISTRIBUTION OF STATUS GROUPS - REAL





### 8.6.1 Significant Items - REAL

By examination of the relevant Item diagrams which have the same topology as the main Space diagram, Domains A and B may be differentiated by reference to the following Survey of Design items:

Item 8. The Industrial Designer is skilled in presenting Design concepts in writing.

Item 9. The Industrial Designer is skilled in understanding the financial implications of Design decisions.

Item 10. The Industrial Designer is skilled in marketing techniques.

Item 13. The Industrial Designer has an understanding of normal business practice.

Details of indices of Selectivity and Sensitivity for these items are to be found in Appendix VIII.

If one compares the percentage of individuals in Group A who score below median on the above items then some dissatisfaction with actual performance is evident.

The percentages scoring below median are as follows:

|         |     |
|---------|-----|
| Item 8  | 65% |
| Item 9  | 52% |
| Item 10 | 60% |
| Item 13 | 51% |

If one then takes the percentages of individuals who score above median in Group B then satisfaction and perhaps complacency is obvious. These percentages are as follows:

|         |      |
|---------|------|
| Item 8  | 81%  |
| Item 9  | 100% |
| Item 10 | 80%  |
| Item 13 | 88%  |

It may be inferred that there are mismatches between the perceptions of Group A (Commercial) and Group B (Educational).

Further inferences may be drawn from the comparison of IDEAL and REAL in terms of the satisfaction or dissatisfaction experienced in connection with particular questions.

In the best of all possible worlds IDEAL and REAL would coincide. The gap between them might be construed as a rough measure of the satisfaction experienced. It might also be taken to be a measure of insight into one's perception of IDEAL or REAL.

Differences between IDEAL and REAL scores for each of the Status groups may be found in graphical form at Appendix VIII, where percentages of "Agree" scores are displayed.

With these possible approaches to interpretations in mind, the following remarks may apply:

Manufacturers and Designers are dissatisfied with the standard of written presentation on the part of the Industrial Designer, whereas the Students and at least some of the Lecturers seem satisfied.

Group A is unanimous in their dissatisfaction with the financial skills of the Industrial Designer. Group B is divided on the subject.

Group A tends towards dissatisfaction in the matter of marketing techniques. Group B is much more satisfied.

Group A is not satisfied about the knowledge of the Industrial Designer about normal business practice. Group B is fairly satisfied.



## 8.7 Summary

Scores from the Design Survey for IDEAL and REAL were subjected to an MSA1. Divisions were revealed on the main Space Diagram between Group A (Commercial/non-Poly) and Group B (Educational/Poly). The main factors which contributed to these divisions were identified.

In IDEAL terms Manufacturers looked towards improvements in a span of practical skills: marketing, financial, economic, computing. They were also concerned to improve work disciplines and attitudes.

In REAL terms, Manufacturers were not satisfied with writing skills, financial and marketing techniques and the Designer's understanding of normal business practice.

Tentative remarks about mismatches and satisfaction with regard to particular questions on the part of these Groups were proposed.

## MOLECULAR VIEWS - LOGLINEAR ANALYSIS

9.1 Introduction

This chapter takes up the divisions revealed in the two previous chapters and subjects them to a more detailed analysis. Using Loglinear Analysis an examination is made of two groups of domains proposed in Chapter 7:

- a. High Order Abilities (H), Attitudes at Work (A), Values (V)
- b. Presentational Skills (P), and Knowledge & Knowhow (K)

A further differentiation of Presentational Skills is made into Visual Presentation (VIS) and Verbal Presentation (VERB)

This examination shows different trends and patterns of association between the domains in subgroups such as:

- a. Status: Students, Lecturers, Designers, Manufacturers
- b. Institution: Leicester Poly, Teesside Poly, Central School of Art & Design, London
- c. Year: 1st, 2nd, 3rd, Postgraduate Years
- d. Class: Class of B.A degree.

9.2 Linear models

Classical linear models may be said to begin with the work of Gauss and Legendre (Stigler 1981), and were used in describing astronomical data. Errors in this were largely due to faulty measurement and the Gaussian or Normal distribution curve was developed to describe the properties of such errors.

Later on in the 19th Century the same curve was seen as appropriate in biological data where variability in such characters as height or weight was encountered. Gauss showed that modelling or fitting data did not depend on an assumption of normal distribution but on that of a constant variance.



Classical linear models are applied to continuous measurement type data. In the case of discrete and/or binary data the assumptions of normality and constant variance do not apply. Generalized linear models using such discrete or frequency data are based on binomial or multinomial or Poisson distributions.

Among the range of generalized linear models are loglinear models and these are appropriate for discrete categorical data that can be expressed in the form of frequency tables.

In the present study the raw data was recoded into binary form above or below the median applicable to each particular item. This recoding had already been found essential to perform the SSA and MSA analyses discussed in the preceding chapters.

Loglinear modelling has been used for a variety of purposes. Among these may be noted models for:

- Motor insurance claims (Baxter et al 1980)
- Education testing (Anderson 1973)
- Daily rainfall (Coe & Stern 1982)
- Lung cancer mortality rates (Manton et al 1981)
- Health Sciences in general (Fleiss 1981)

Recent work such as Teather (1986) has concentrated on the medical applications of such techniques and a discussion of techniques in medical diagnosis is to be found in Morton & Teather (1984).

### 9.3 Patterns, Parsimony and Prediction

The problem of looking intelligently at numerical data demands the formation of patterns that can in some way represent this data in a meaningful way. The patterns must allow important characteristics to be described in terms of a limited number of qualities or parameters which the mind can encompass easily.

The representation or model of the data provides a more or less good replacement or fit for the raw data. By including enough parameters the fit can be made perfect but in so doing nothing has been achieved and no easily understandable pattern will have emerged. A "good" model is a parsimonious one which enables the analyst to hold the

data within the hollow of his mind. The "good" model may also permit better prediction than the unnecessarily complex one.

" All models are wrong, some though are better than others and we can search for the better ones."

McCullough & Nelder (1984) page 6.

#### 9.4 Loglinear Analysis

Loglinear techniques are concerned with describing the associations between variables. At a relatively simple level, say when a 2x2 contingency table is being analysed, Pearson's chi-square test may be suitable. Everitt (1977) discusses these techniques.

This study deals with higher dimensional contingency tables and for this Loglinear techniques which make use of G-square or the likelihood ratio are relevant. This test statistic has advantages over the more limited Chi-square. By means of G square both the probability of fit of a statistical model may be calculated and also the significance attaching to the various components of a model, that is how much they contribute to the eventual fit. In this respect see McCullough & Nelder (1984) and Everitt (1977) for full details.

Models with many variables are potentially numerous, but what is sought is the most parsimonious one that will describe the associations in the data.

Even with three variables a, b, c the possible associations will contain the following combinations:

a b c  
a\*c b  
a\*b c  
b\*c a  
a\*c a\*b  
b\*c a\*b  
b\*c a\*c  
a\*b a\*c b\*c  
a\*b\*c

\* Indicates association between variables



The first of these models:  $a \ b \ c$  is termed the Independence model. This shows no associations between any of the variables - they are unrelated.

The last:  $a*b*c$  shows associations between each and every one of the variables. This is the Saturated model referred to below which fits the data exactly.

The third:  $a*b \ c$  indicates that there are associations between variables  $a$  and  $b$ , but that variable  $c$  is independent of either.

The selection of models in between may represent the data in a more economical way, and the most parsimonious of these is sought.

The models finally selected in this chapter have various degrees of success in fitting the data. At one extreme a model may fit the observed data exactly and includes all possible parameters. This is termed the Saturated model. At the other extreme the model may barely fit the data and the fit may just be acceptable at the conventional significance limit.

Quoted with each model are three numbers, respectively G-square, degrees of freedom, probability ( $p$ ). It should be noted that this last indicates the fit of the model.

For an adequately fitting model, G-square should be of the same magnitude as the degrees of freedom. If G-square is much greater than the degrees of freedom, the fit of that model is not so good and the corresponding probability value is small.

It should be noted that probability in this context is probability of fit and says nothing about any strength of association in any of the components of the model in question. It is however possible to assess the strength of association in terms of the changes in G-square involved when a term is added to or subtracted from the complete model (Everitt 1977). As a result of the present statistical analysis, all suggested models fit at the usual 5% significance level.

## 9.5 Computer Analysis

When four or more variables are considered the number of models available for investigation increases considerably. The statistical program HILOGLINEAR in the SPSS package has the capacity to deal with 10 variables at a time, but problems in the interpretation of such complicated models are severe. In this study therefore three, sometimes four, variables were tackled at a time.

The procedure adopted with HILOGLINEAR was to model firstly the saturated model, that is the one with the total factors associated with each other. HILOGLINEAR will then progressively eliminate one at a time in a stepwise selective process the elements in the model which do not contribute significantly to the fit. The final model arrived at is the most effective and parsimonious one.

Two groups were selected, partly on pragmatic grounds, but also as a result of the SSA analysis noted in Chapter 7.

These were:

- a. Higher Order Abilities (H), Attitudes at Work (A), Values (V)
- b. Presentational Skills (P), Knowledge & Knowhow (K)

This grouping may however be justified on intuitive grounds since H, A and V partake of the cognitive and affective, whereas P and K tend to the pragmatic. However it is just one possible way of dealing with the variables.

The loglinear approach was applied to these two groups of variables to seek to identify differences in models for the various status groups ( Student, Lecturer etc) and the Institutions considered in this research project.

The models are presented in tabular form in this chapter and the areas of divergence between sub-groups indicated. Chapter 10 discusses the implication of the research findings for Design Education and for Industrial Design in general.



TABLE 13A STATUS SUBGROUPS - LOGLINEAR MODELS  
HIGHER ABILITIES, ATTITUDES AT WORK, VALUES

IDEAL

REAL

Entire sample N=204

H\*V\*S A\*V H\*V  
 20.57753/13/.082

A\*S V\*S H\*A H\*V A\*V  
 10.89243/16/.816

Students N=143

H\*V A\*V 1.6955/2/.428

H\*A A\*V 3.24724/2/.197

Lecturers N=12

H\*A A\*V .90805/1/.341

H\*V A\*V 5.4115/1/.462

Designers N=29

H\*A A\*V 5.09162/2/.078

H\*A H\*V 9.6037/2/.619

Manufacturers N=15

H\*A H\*V 1.24295/1/.265

A\*V 3.99334/4/.407

Note that G square statistic (the Likelihood Ratio), Degrees of Freedom, and the Probability of Fit for the model are quoted throughout after the model. Notation denoting associations are as set forth in 9.4.

## 9.6 Differences between Status subgroups

Status subgroups, that is Students, Lecturers, Designers and Manufacturers, were examined, using H A V and P K in order to determine the optimum model which would describe each group. The entire group was first modelled with Status (S) built in, and then the separate subgroups were analysed .

### a. Higher Order, Attitudes, Values

Analysis of the entire sample ( Table 13A) reveals that Status is related to Higher Order Abilities (H) and Values (V) in the IDEAL, whereas in the REAL, Status is associated with Attitudes at Work (A) and Values (V) and that these two components are in separate dyads.

There are associations between A and Status, but it is noteworthy that A appears in REAL in more terms of the model than in IDEAL. It could be suggested that A plays a more central role in REAL than in IDEAL.

In Higher Order, Attitudes to work and Values and Orientations Lecturers and Industrial Designers present very similar models in the IDEAL, but differences arise in REAL. It may be assumed that this reflects modifications of Ideal in the face of different experience and different perceptions of what really goes on in Design.

The position is possibly complicated by the fact that in this study the classifications Lecturer and Designer may sometimes overlap and at this stage it is not possible to determine which are Lecturers, which are Designers and which assume a dual role. Future studies may possibly differentiate on these lines. It is be noted that in Higher Order Abilities (H), Attitudes at Work (A), and Values and Orientations (V), Manufacturers differ both in IDEAL and REAL from Students, Lecturers and Industrial Designers.



TABLE 13B STATUS SUBGROUPS - LOGLINEAR MODELS  
PRESENTATION SKILLS AND KNOWLEDGE & KNOWHOW

Entire sample N=204

IDEAL

REAL

P\*K S 5.43081/9/.795

P\*K P\*S 1.664410/6/.949

Entire sample N=204 Visual, Verbal and Knowhow

VIS VERB\*KNOW STATUS  
 10.06503/9/345

VIS VERB\*KNOW VERB\*STATUS  
 4.12422/6/.660

Students N=143

VIS VERB\*KNOW VIS 0/0/1

VERB\*KNOW 0/0/1

Lecturers N=12

VIS VERB\*KNOW 0/0/1

VIS VERB KNOW 2.38538/1/.122

Designers N=30

VIS VERB\*KNOW 0/0/1

VIS VERB KNOW 2.833421/1/.092

Manufacturers N=16

VIS 2.59834/3/.438

VIS VERB KNOW .96218/1/.327

b. Status Subgroups- Presentational Skills and Knowhow

In the previous analyses Presentational Skills had been considered as one entity. There had been indications, however, in the SSA that Q6 Visual Presentation was in a different category from the other mainly Verbal Presentation questions. It was therefore decided to examine Presentation in more detail, splitting it into Visual (VIS) and Verbal (VERB).

VIS consisted solely of Question 6, and VERB of Questions 7 & 8.

This echoes the above result with PRES, but it is evident that Visual Presentation is a separate entity and is a sine qua non for all exponents of Design.

In Visual, Verbal and Knowhow the configurations for Student IDEAL and REAL and for Lecturer and Designer IDEAL are identical, with the associations between Verbal and Knowhow decidedly stronger in the Student model. The weaker links in Lecturer and Designer part company when reality is invoked. It might be supposed that the Student sees Design in a quasi-Romantic or even a naive way. For him the Designer is the focal person, presenting his ideas with verve and verbal vivacity, knowledgeable of others' expertise but controlling the whole process of Design. Both Lecturers and Designers would like to subscribe to this view but are more aware of what goes on and cannot but agree with the Manufacturer REAL model.

It may be suggested that a crucial pattern is to be found in the Manufacturer IDEAL model. This differs radically from any other model and contains but one domain - Visual. One may suppose that for the Manufacturer the Designer qua Designer is nothing but a producer of visual ideas, an expert in his field but not somebody to exert a controlling influence on the whole process.



TABLE 14A INSTITUTIONS - LOGLINEAR MODELS  
HIGHER ABILITIES, ATTITUDES AT WORK, VALUES

All Institutions N=150

IDEAL

REAL

A\*V H\*V V\*I 18.43582/14/.188      A\*V H\*A I 13.39438/16/.644

Leicester Poly N=55

H\*V A\*V .05319/2/.974

H\*A A\*V .26609/2/.875

Teesside Poly N=56

H\*A H\*V 2.75278/2/.252

H\*V A\*V 5.61359/2/.06

Central School of Art & Design, London N=38

H\*A A\*V .49828/2/.779

A\*V 2.93514/4/.569

## 9.7 Differences between Institutions

### a. Higher Abilities, Attitudes at Work, Values

If one takes Leicester and Teesside together, bearing in mind both IDEAL and REAL mode, there is an obvious bias towards Value, whereas London shows Attitudes at Work in the ascendant. It may well be that this well be a reflection of the ethos of a provincial Institution compared with a metropolitan one. There are no doubt differences in milieu, with London practically devoid of campus life, with a wider student catchment, including overseas students, in general reflecting more of the frenetic and the pragmatic atmosphere of the metropolis. It may be supposed significant that the London REAL model is almost identical with that of the Manufacturer.



TABLE 14B INSTITUTIONS - LOGLINEAR MODELS  
PRESENTATION (VISUAL, VERBAL) AND KNOWHOW

IDEAL

REAL

All Institutions: N=150

P\*K K\*I 2.9335/4/.569

P\*K P\*I 6.11254/4/.191

Leicester: N=55

P\*K I 0/0/1

P\*K I 0/0/1.0 Sat. model

Teesside N=56

P\*K I 0/0/1

P\*K I 0/0/1.0 Sat model

London: N=38

P\*K I 0/0/1

K I .43273/2/.805

Leics N=55

Vis Verb\*K 0/0/1

Vis Verb\*K 0/0/1

Tees N=56

Vis Verb\*K 0/0/1

Vis Verb\*K 0/0/1

London N=38

Vis Verb\*K 0/0/1

Vis Verb .95273/2/.621

b. Differences between Institutions - Visual, Verbal, Knowhow

The models are virtually identical in the IDEAL mode for all three Polys. Differences arise in REAL where Leics and Teesside are identical with strong associations between Presentation and Knowledge and Knowhow. London again shows a different model.

As with Status groups above a further differentiation of Presentation Skills into Visual and Verbal Skills was made.

Again the models are identical in IDEAL but in REAL there is a difference in London. London REAL model omits K and leaves Verbal and Knowhow as independent domains.

This in turn is not too dissimilar to the fully independent model of Visual Verbal and Knowhow characteristic of Lecturer, Designer and Manufacturer REAL. It may be plausible to suggest that the difference noted in London REAL is in fact an Institution effect and that Lecturers at London effectively reflect CNAA priorities, as shown in the models for Upper Class of degree in 9.8.



TABLE 15A YEARS - LOGLINEAR MODELS  
HIGHER ABILITIES, ATTITUDES AT WORK, VALUES

IDEAL

REAL

Entire sample    N=143

H\*V V\*A H\*Y 27.10379/26/.404    H\*V\*A\*Y 0/0/1 Sat model

Year 1    N=50

H\*V V\*A .35377/2 /.838    H\*V\*A 0/0/1 Sat. model

Year 2    N=32

H\*V 2.37859/4/.667    H\*V\*A 0/0/1 Sat. model

Year 3    N=35

V\*A 7.10953/4/.130    H\*V V\*A 2.09274/2/.351

Years 4+5    N=26

H A 6.4508/5/.265    H\*V V\*A 1.34135/2/.511

## 9.8 Differences between Years

### a. Higher Order Abilities, Attitudes at Work, Values

Whereas in REAL there do not seem to be any consistent differences between Years, in IDEAL there are indications of progressive change. In Year 1 associations exist between Higher Order and Value, and between Value and Attitudes.

There seems a period of indecision in Years 2 and 3 with Attitudes taking a back seat at first to Higher Order. Year 2 evidences a more theoretical approach and Year 3 a more job-orientated one.

These dyads together made up the model for Year 1 and seem to be successively tried out during the rest of the Years 2 and 3.

### b. Presentation and Knowhow

In both REAL and IDEAL and in all Years the final model is the saturated one, that is there are strong associations overall between P and K.

When Presentation is divided into Visual and Verbal the models throughout are similar, with one exception :

#### Year 1 REAL

where the model is:

Vis Verb .72562/2/.696

A possible explanation of this divergence may lie in the fact that Year 1 have not at this stage enough experience of the world of Design to make an informed appraisal.



TABLE 16A CLASS OF DEGREE - LOGLINEAR MODELS  
HIGHER ABILITIES, ATTITUDES AT WORK, VALUES

IDEAL

REAL

Entire Sample n=44

H\*C A\*V 5.82629/9/.757

H\*A\*V C 6.47994/6/.372

Upper N=26

A\*V 5.33223/4/.255

A\*V .3546/3/.315

Lower N=18

H 3.08529/6/.798

H\*A\*V 0/0/1

### 9.9 Differences between Class of Degree

It proved possible to obtain the BA degree results for 44 students. These were made up as follows:

4 First Class  
22 Upper Second  
13 Lower Second  
2 Third  
3 Referred or Fail

In the analysis First Class and Upper Second were grouped together and labelled "Upper Division" and the remainder was labelled "Lower Division".

#### a. Class of Degree - Higher Abilities, Attitudes at Work, Values

The "Upper" group was assumed to reflect the CNAA model since it gained their approval.

The overall model shows that Class of Degree is associated with H in the IDEAL. H appears in the models for Lower Class of Degree, both in IDEAL and REAL. In fact, however, examination of the scores reveals preponderance of sub-median scores for Lower Class. The association between H and Lower Class is actually a negative one. H does not appear in the model for Upper Class of degree because it is distributed equally above and below the median and is thus not salient in the model.



TABLE 16B CLASS OF DEGREE - LOGLINEAR MODELS  
PRESENTATION (VISUAL, VERBAL) KNOWHOW

IDEAL

REAL

Entire Sample N=44

VIS VERB\*K VERB\*C  
.450114/2/.798

VIS VERB\*K C  
1,25143/3/.741

Upper N=26

VERB\*K 0/0/1

VIS VIS VERB 3.47413/2/.176

Lower N=18

VIS 3.05328/3/.383

VIS K 2.151/2/.341

b. Class of Degree - Visual, Verbal, Knowhow

As in the all other student models Visual Presentation is regarded as highly important and appears equally in the Lower Division.

Verbal Presentation in this context is necessary to communicate with the CNAA examiner but may be indicative of a higher level of intellectual rigour. This hypothesis cannot be examined in the present study since only non-verbal intelligence was tested.

It is noted that the models for the Upper division bear a high degree of resemblance to those of Designer and Lecturer, both in IDEAL and REAL. Models for the Lower division are very similar in IDEAL and REAL to those of the Manufacturer.

c. Class of Degree and Personality scores on EPQ

Models using scores from the Eysenck Personality Questionnaire were as follows:

Entire Sample N=44

ANX\*EXT C 2.44618/3/.485

This model shows personality factors as independent of the Class of degree obtained, although they themselves are associated. Further analysis which also used the third personality dimension proposed by Eysenck - Psychoticism, merely confirmed that the Eysenck Personality Questionnaire does not discriminate between Classes of Degree.



#### d. Class of Degree and Value Judgements

An analysis was attempted using data from the Solomons' Survey of Values (SSV). Full details of this survey, together with definitions of the values measured, are to be found in Appendix V.

This preliminary analysis used five values: Aesthetic (AES), Social (SOC), Theoretic (THEO), Pragmatic (PRG), and Dominant (DOM). These, together with Class of Degree (CLASS), made six factors for analysis, and the result was a most complicated and unmanageable saturated model. No attempt was made to interpret or explicate such a model, but it is given below merely to illustrate the problems sometimes encountered when dealing with so many factors:

THEO\*PRG\*SOC\*DOM  
THEO\*PRG\*SOC\*CLASS  
THEO\*PRG\*DOM\*CLASS  
THEO\*AES\*SOC\*DOM  
THEO\*AES\*SOC\*CLASS  
THEO\*AES\*DOM\*CLASS  
THEO\*SOC\*DOM\*CLASS  
PRG\*AES\*SOC\*DOM  
PRG\*AES\*SOC\*CLASS  
PRG\*AES\*DOM\*CLASS  
PRG\*AES\*DOM\*CLASS  
PRG\*SOC\*DOM\*CLASS  
AES\*SOC\*DOM\*CLASS  
THEO\*PRG\*CLASS

A similar course of action to that taken with the Survey of Design was decided. A correlation matrix of the five values revealed two possible groupings:

Aesthetic and Social

Theoretic Pragmatic and Dominant

e. Class of Degree - Aesthetic and Social Values

There is virtually no difference in model between the Upper and Lower Class of degree. AESTHETIC in this context is defined as the appreciation of beauty and style - not necessarily a cogent creation of elegance. It is not to be equated with creativity nor visual presentation as in Question 6 of the Survey of Design. This may explain why it is deleted in the final model and SOCIAL is left. SOCIAL in this context is defined as concern for others and this factor enters both in the conceptual vocabulary of the Designer and figures in the Values section of the Survey of Design.



TABLE 17A CLASS OF DEGREE - LOGLINEAR MODELS  
AESTHETIC AND SOCIAL VALUES

Entire sample n=44

CLASS SOC            3.96081/5/.555

Upper n=26

SOC                    1.79003/2/.409

Lower n=18

SOC                    2.151/2/.341

TABLE 17B CLASS OF DEGREE - LOGLINEAR MODELS  
THEORETIC, PRAGMATIC AND DOMINANT VALUES

Entire sample N=44

THEO\*CLASS DOM\*CLASS                      3.93351/5/.559

Upper N=26

THEO\*PRG\*DOM                                      0/0/1

Lower N=18

THEO DOM    2.40335/5/.791

f. Class of Degree - Theoretic, Pragmatic, and Dominant Values

Pragmatic in this context is defined as stressing the usefulness of things. It is also concerned with the selling or presenting of products and there is an allusion here to Verbal Presentation characteristic of the Upper degree class. In the Upper model the saturated THEO\*PRG\*DOM indicates strong associations. This would point to a system whereby any Design situation would be evaluated globally, that is bearing in mind all three factors and their possible effects one upon the other - in all respects a fecund situation.

By contrast the independence of the factors in the model of the Lower class of degree and the absence of Pragmatic from the model would point to a less seminal approach, whereby there are mental boundaries between the factors Theoretical and Dominant.

An interesting study which is beyond the remit of this study might be to compare two such groups of Class of degree to find whether there was such a characteristic difference in their thinking, using such measures of lateral, creative or divergent thought as are available.



## 9.10 Summary

The rationale for Loglinear analysis and the notation for models were briefly explained and various groups were modelled, using various sets of variables:

Higher Order Abilities, Attitudes at Work, Values & Orientations

Presentational Skills (Visual & Verbal) and Knowhow

Anxiety and Extraversion personality dimensions (EPQ)

Aesthetic and Social Values (SSV)

Theoretic, Pragmatic and Dominant Values (SSV)

Differences were found between groups, notably between Manufacturers and the other Status groups, between London and the other Institutions, between the various Years of the Design course, and between "Upper" and "Lower" Class of Degree.

So far as personality is concerned no significant differences were found between Class of Degree.

It is suggested that possible avenues for future research might be to use combined MSA and Loglinear analyses with different and more extensive samples, especially of Designers, Manufacturers and also Consumers.

It is also suggested that further study of Class of Degree differences might concentrate on verbal and oral ability, using existing standardised measures or even validating special ones for Design purposes. It may also be fruitful to investigate differences in this group, using measures of lateral, creative or divergent thought

Chapter 10 goes on to discuss the implications of the models revealed by the loglinear analysis.

## CHAPTER 10

### LOGLINEAR MODELS OF DESIGN - IMPLICATIONS AND DISCUSSION

#### 10.1 Introduction

Following the global view afforded by Multidimensional Scalogram techniques, analysis was undertaken to give a more detailed view of the way in which the conceptual domains proposed as a result of the Smallest Space analysis are associated in each sub-group of the Design population. The analogy is a chemical one and presents models in which domains are bonded into a larger conceptual molecule.

Using Loglinear analysis an attempt was made to fit data from the Survey of Design and some of the other behavioural measures to certain optimal and parsimonious models. Because of difficulties in dealing with too many variables at once, models were explored using two groupings:

Higher Order Abilities

Values & Orientations

Attitudes at Work

and

Visual Presentation Skills

Verbal Presentation Skills

. Knowledge & Knowhow

In the previous chapter models were presented in a tabular form, using loglinear conventional notation and including the necessary mathematical details. In this chapter the results are discussed in more general terms, together with the implications of the different models obtained by way of loglinear analysis.

#### 10.2 Schematic Semantic Diagrams

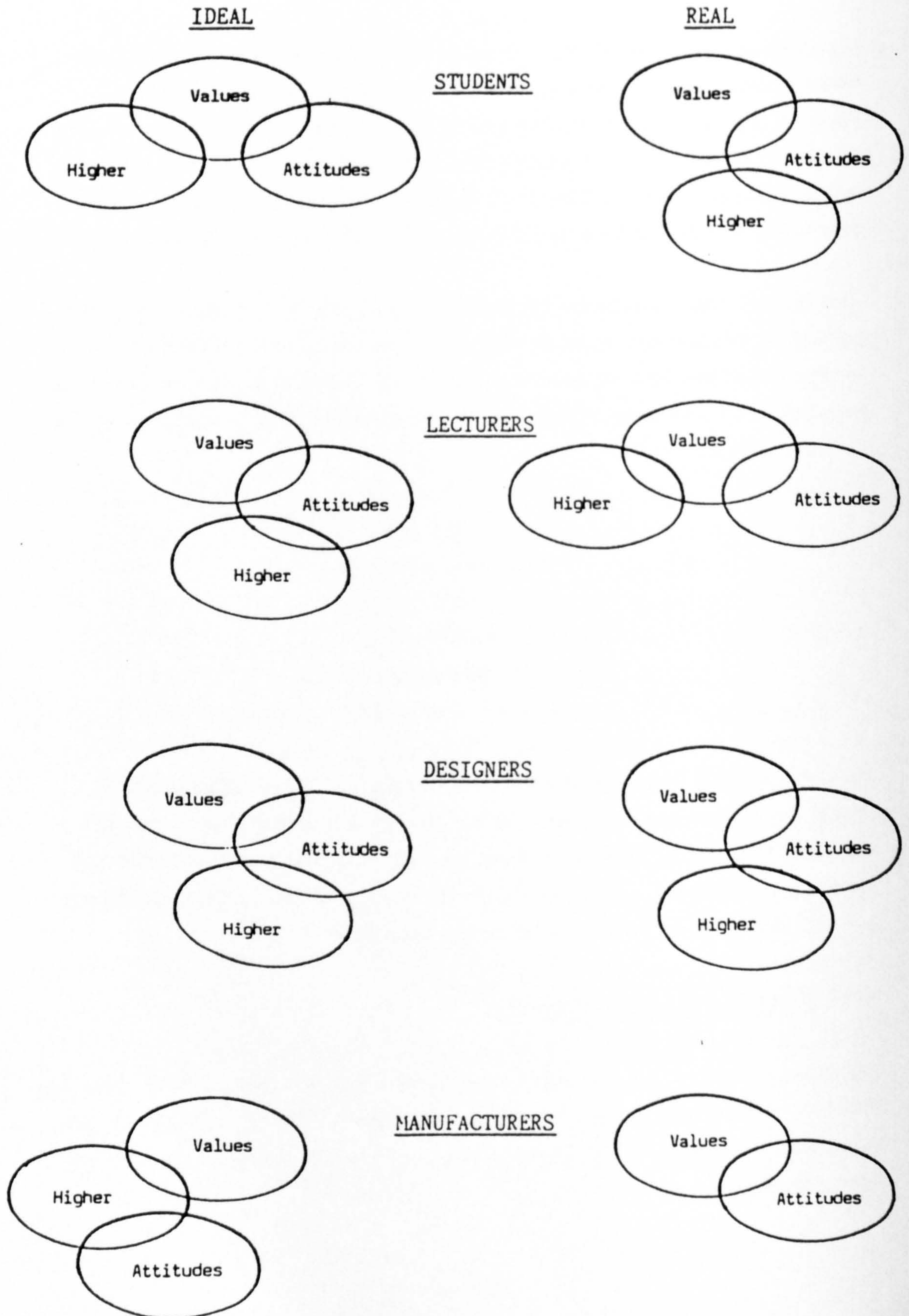
Interleaved opposite the appropriate text are diagrams which show in schematic form the extent to which conceptual models overlap or are distinct. As in the loglinear analysis the diagrams are presented in two groupings:



SCHEMATIC SEMANTIC DIAGRAMS - STATUS SUBGROUPS

To show the semantic overlap or distinction between conceptual models for Student, Lecturer, Designer, and Manufacturer

Higher Order Abilities, Attitudes at Work, Values





Higher Order Abilities, Attitudes at Work, Values  
and  
Visual Verbal and Knowhow

A graphical equivalent of the Loglinear notation of Chapter 9 is provided to show association or independence. The Student IDEAL model for Higher Order, Attitudes at Work, and Values is given in Chapter 9 as:  $H*V A*V$ . This is indicated in Diagram 22 by overlapping Values with Higher Order, and Values with Attitudes. Higher Order, however, remains separate from Attitudes.

### 10.3 Status Subgroups

If one examines the model for all Design practitioners using the first set of domains - Higher Order, Attitudes at Work and Values - it is evident that Values occupy a salient position in the IDEAL model since Values appear in a large number of associated dyads. Conversely Attitudes at Work occupy the salient position in the REAL model.

Taking the subgroup models separately it can be seen that Students, Lecturers and Designers exhibit variations on a theme. From the IDEAL point of view Lecturers and Industrial Designers present identical models. From the REAL point of view. Students and Industrial Designers are identical. Manufacturers show differences from the other groups both in IDEAL and REAL.

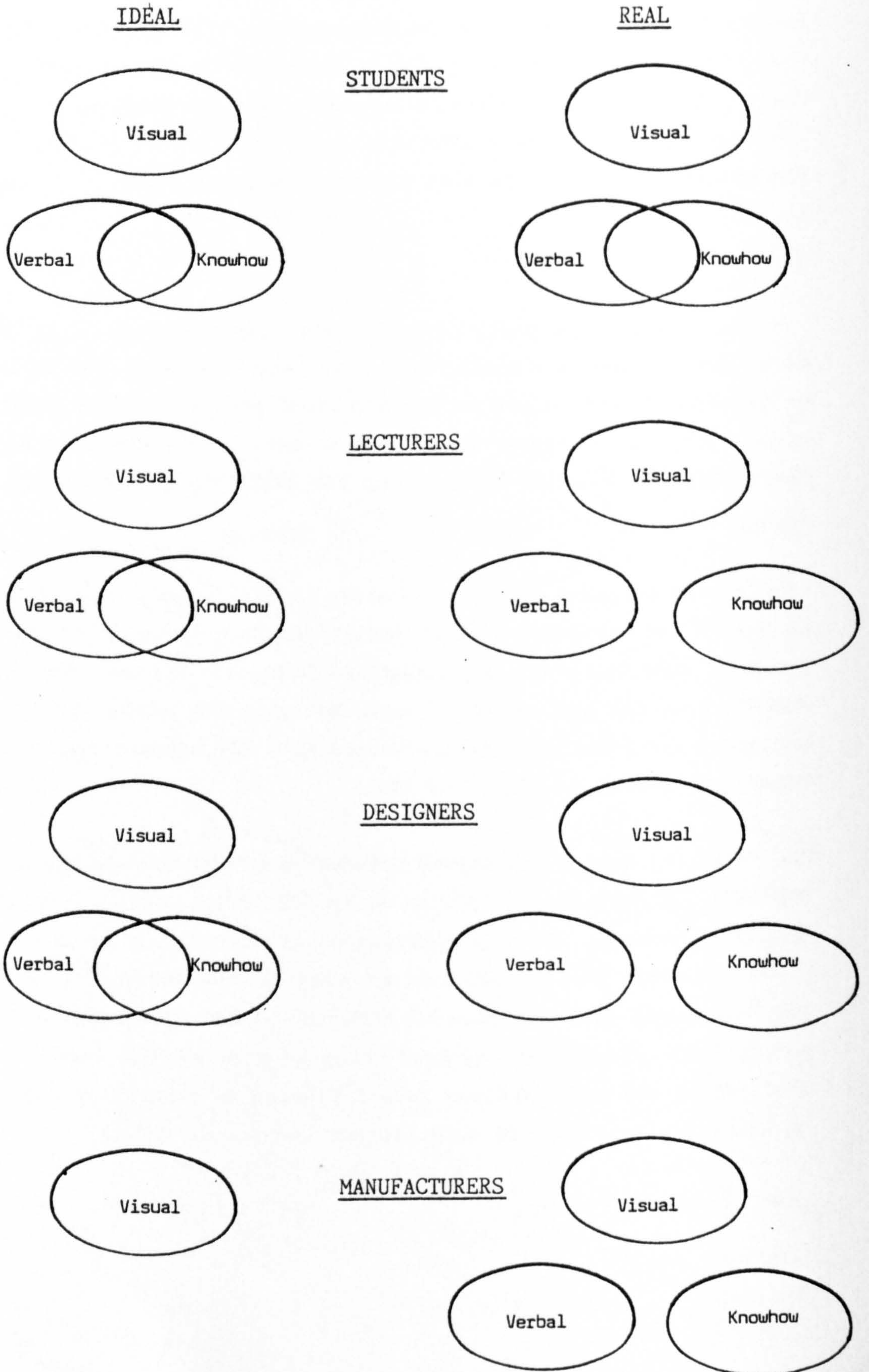
The fact that such a gap exists between Manufacturers and the rest may well indicate basic differences in priorities, that is value judgement systems. No firm conclusions can be arrived at in the present study, since the SSV was not administered to Manufacturers and Designers. This may however form the basis for further research, particularly so since it has been shown in many studies that attitudinal and value systems have influence on perception and hence on conceptualization. In this respect see Sherif (1935),



SCHEMATIC SEMANTIC DIAGRAMS - STATUS SUBGROUPS

To show the semantic overlap or distinction between conceptual models for Student, Lecturer, Designer, and Manufacturer

Visual, Verbal, Knowhow





Carter(1949), Bruner (1953), Taifel (1959), Gilchrist (1954), Postman (1948).

The second set of domains - Visual, Verbal & Knowhow - shows Students identical with Lecturers and Industrial Designers in IDEAL but different in REAL. The associations between Verbal and Knowhow are relatively weak in IDEAL with Lecturers and Designers and their model becomes identical with that of Manufacturers in REAL.

It may plausibly be construed that the experience of Lecturers Industrial Designers and Manufacturers leads them to a congruent view that in reality Verbal Skills and Knowhow do not necessarily go hand in hand.

Visual Skills occupy an independent position throughout all groups and this may reasonably be taken as an indication of its importance in the whole art and activity of Design, indeed sometimes pre-empting all other domains in certain groups.

Since Visual is the single component in the Manufacturer IDEAL model it evidently occupies a dominant position in the conceptual model. It may be speculated that the Manufacturer requires above all things that the Designer present an elegant and attractive product. A corollary may well be that the Manufacturer would prefer the Designer to confine his activity to this and not to coordinate a team of experts considering all other aspects of the commercial enterprise.

Whether this reflects a management view that specialists should confine themselves strictly to their fields or a view that Industrial Designers cannot or should not involve themselves in other expertises or possibly a certain anxiety that Industrial Designers might usurp commercial functions and acquire power - all these are questions which may well form suitable topics for further study. It would appear that herein is a cause for friction and misunderstanding.

There are however indications in Student models, both IDEAL and REAL, with their consistent link between Verbal and Knowhow that support the frequently repeated sentiment by Students that the



Industrial Designers should be the key element. According to them, not only should he provide the creative concept but should also be the pivot and facilitator in an expert industrial team orchestrating ideas and following them through the entire process of Design.

From the IDEAL viewpoint Lecturers and Industrial Designers both subscribe to this view.

#### 10.3.1 Implications - General

The results presented here indicate a lack of common understanding between certain subgroups. The implications are educational both in the formal sense as applied to teaching in the Institutions, but also in the wider sense of acquisition of insight into the situation by all concerned in the Design process.

There are many current initiatives on the part of the Design Council and other official bodies which are aimed at promoting better and broader commercial skills in Design. These stem mainly from concern that we are not achieving the progress that we should bearing in mind that we are:

"... a country with an enormous tradition in successful design and manufacture, and an apparently endless supply of inventive genius and creative talent.....now a net importer of manufactured goods."

Height (1986)

Design and its place in Industry has been a much debated topic in Great Britain during the past two years with 1986 being the Conference for Industry Year. A conference held at the Royal College of Art entitled the "Redesign of Design" was officially opened by John Butcher, then Under Secretary of State for Industry. The Prince of Wales also attended. This conference considered the demands which rapid advances in technology and fierce competition were putting on our capacity to design, develop and sell products. In particular stress was placed on the changing role of the Industrial Designer who should no longer be regarded as a back room boy but vitally involved with company policy.

In 1987, Ben Austen, Education Officer at the Design Council produced a booklet, " Student Designers for Industry", distributed nationwide to Industry and aimed at senior managers. This booklet pointed out the range of skills that students have to offer and suggested that Industry would do well to become involved with the training of Design students.

Also in 1987 the Design Council launched their travelling exhibition "The Young Creators" which visited many Institutions with the purposes of lauding and demonstrating some of the best practice in Design education. Prominent in the exhibition were statements that the best education included broad based projects to include awareness of manufacturing costs, used needs and real commercial experience.

The latest study (McAlhone 1987), produced for the Design Council examines the design consultancy business and concludes that the design industry is a rapidly expanding enterprise in its own right. It contrasts the undoubted dynamism and expansion of Design with the rather myopic business climate which aims at short terms results and profits. It also mentions the gulf between industry and the Design profession, with many young design graduates turning to the more receptive climates of Italy, America and Japan. From this study at least the "Design Drain" would seem to be a serious problem.

Thus mismatches enter into the official view and one cannot cavil at it. Nevertheless it must be said that the present study shows starkly and in more detail what mismatches actually exist. There are elements of wishful thinking in the official view. What we are faced with in these mismatches is inertia, on the part of Institutions and also Industry.

Official views or syllabi will no doubt have an effect in the long run. But what is required is a momentum, and we are faced with an inertia. It is conceptual and value systems which are legacies from the past and are transmitted to students and eventual Designers. Manufacturers equally transmit amongst their kin systems based on a commercial ethic and more concerned with short term results.

What is required is that common convictions be forged on both sides of the Designer/Manufacturer divide. Management must be fired with longer term aims and with the view that the country (and themselves) can prosper only if Design is allowed a proper and more ample scope. The Designer needs a freedom and an autonomy not absolute and not perhaps as imagined by the student.

For severely practical and economic reasons the new role of the Designer needs to be recognized. Particular industrial situations will require the role to vary and Designer autonomy may perhaps need to be stipulated in contractual terms. Native talents in innovation and design must not be allowed to migrate and our inventive ideas developed abroad.

At the same time Designers must be apprised of the facts of commercial life. Design is not simply Function or Aesthetics although for the Designer this is the core. There are many other factors: practical, social, interpersonal, financial, production - all requiring insight and knowledge. Designers and others within the commercial situation must shed some of the prejudices that they entertain about each other.

It is evident that Design students and to some extent Designers see themselves as pivotal in the Design process, but they must avoid the traps of arrogance and introspection so far as their work is concerned. Both Manufacturer and Designer need to recognize clearly, with an enlightened self-interest and with a certain humility, the needs of the firm, the needs of society and the needs of the consumer.

Design Students must be regarded as Designers in embryo and similarly Management students are Managers in embryo. While it may not be practical to alter the perceptions and concepts of existing Designers and Managers, we should give thought to the future.

It is to be noted that CNAA have devoted much effort to examining the way Managers might manage Design, and have published in October 1984 a series of curriculum recommendations (CNAA 1984). Arising from



this various pilot schemes to apply these recommendations in postgraduate management courses began at Leeds, Leicester, and Kingston Polytechnics in the academic year 1985-86. Further pilot schemes are being developed at Bristol, Middlesex Polytechnics and at the Humberside College of Higher Education.

Emerging from these schemes are striking parallels with the present study. Some quotations from Leeds confirm a potential separation between Designer and Manufacturer:

" It would seem that the designers live a fairly cocooned life where reality is perhaps not real enough. Perhaps they should receive lectures on marketing and new product development. The best designers are often entrepreneurial and understand what business is about e. g. Conran."

" At times he (the Design student) appeared somewhat surprised by our relative naivety regarding the world of design and the design brief in particular....I feel that the experience (i.e. the Pilot scheme at Leeds Poly) has given me a clearer idea of the process of innovation and design in industry, and I am certainly much more aware of the importance of the design brief as a means of initiating, monitoring and evaluating the design process."

" The exercise has given me a valuable glimpse of important issues in the management of design; but not many answers. Perhaps there are no answers, and the realization of the issues is just what this has all been about."

#### 10.4 Years of Design course

Using Higher Order, Attitudes at Work, and Values, IDEAL models show a progressive tendency for domains to abandon associations and to make for independence.

This could support the hypothesis advanced in 4.17 that debutant students entertain many ideas, some fertile some unrealistic about the nature of Design.

SCHEMATIC SEMANTIC DIAGRAMS - YEAR OF COURSE

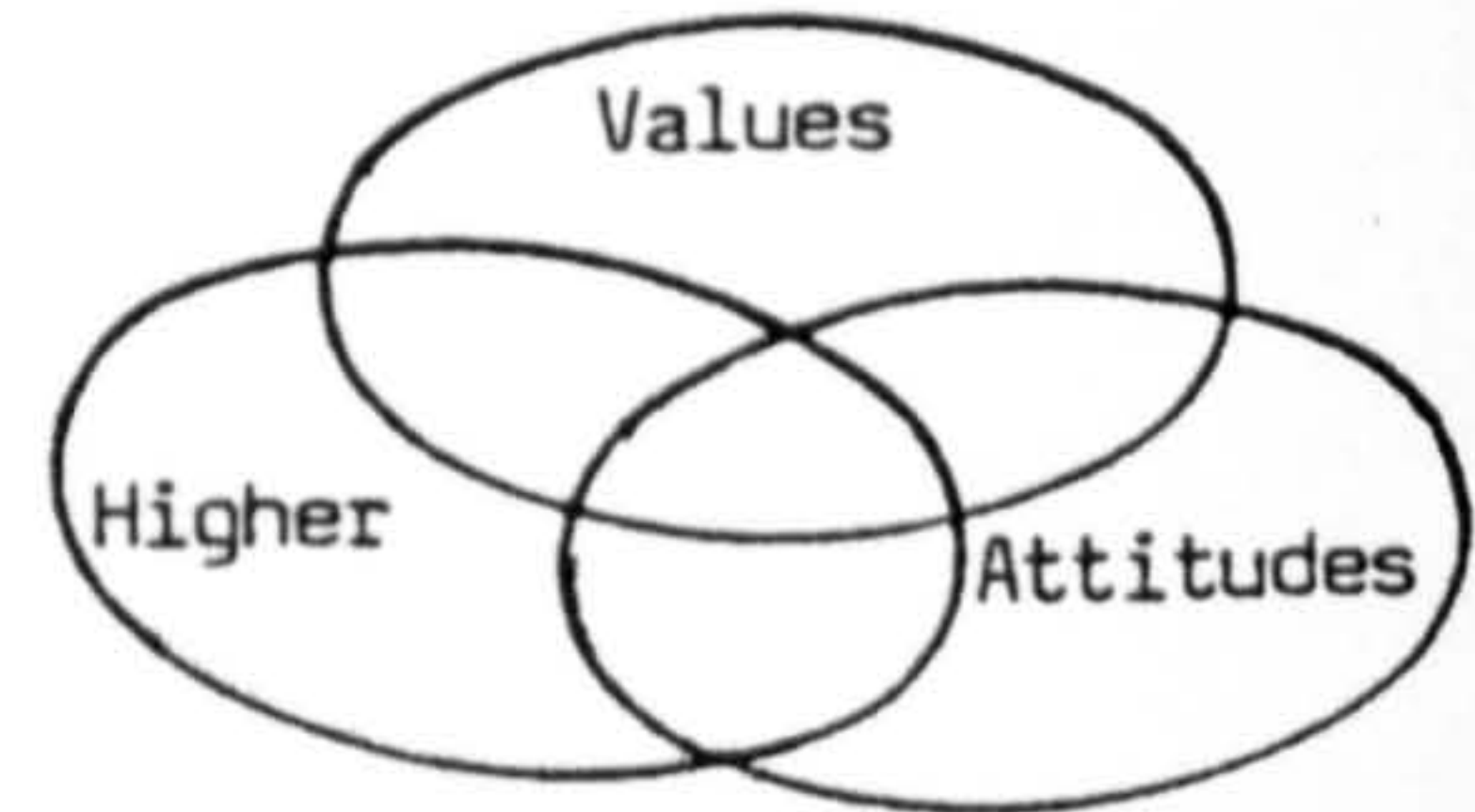
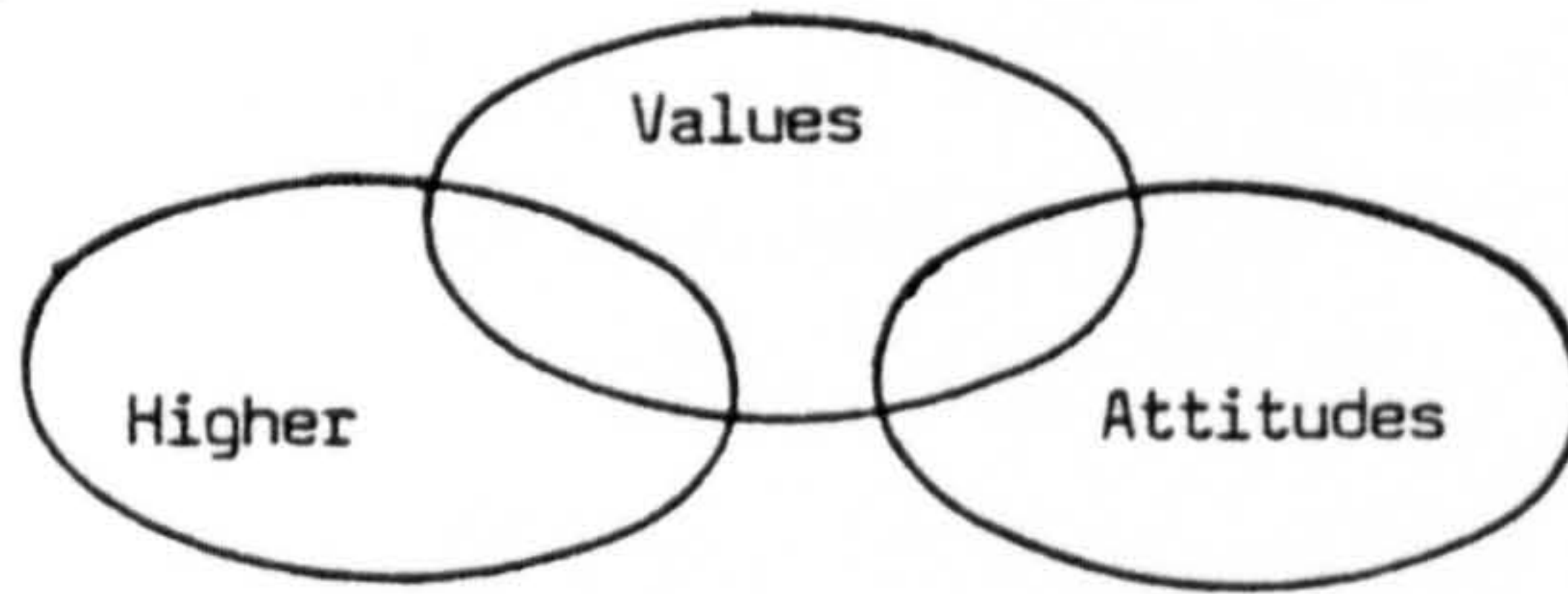
To show the semantic overlap or distinction between  
each Year of the Course

Higher Order Abilities, Attitudes at Work, Values

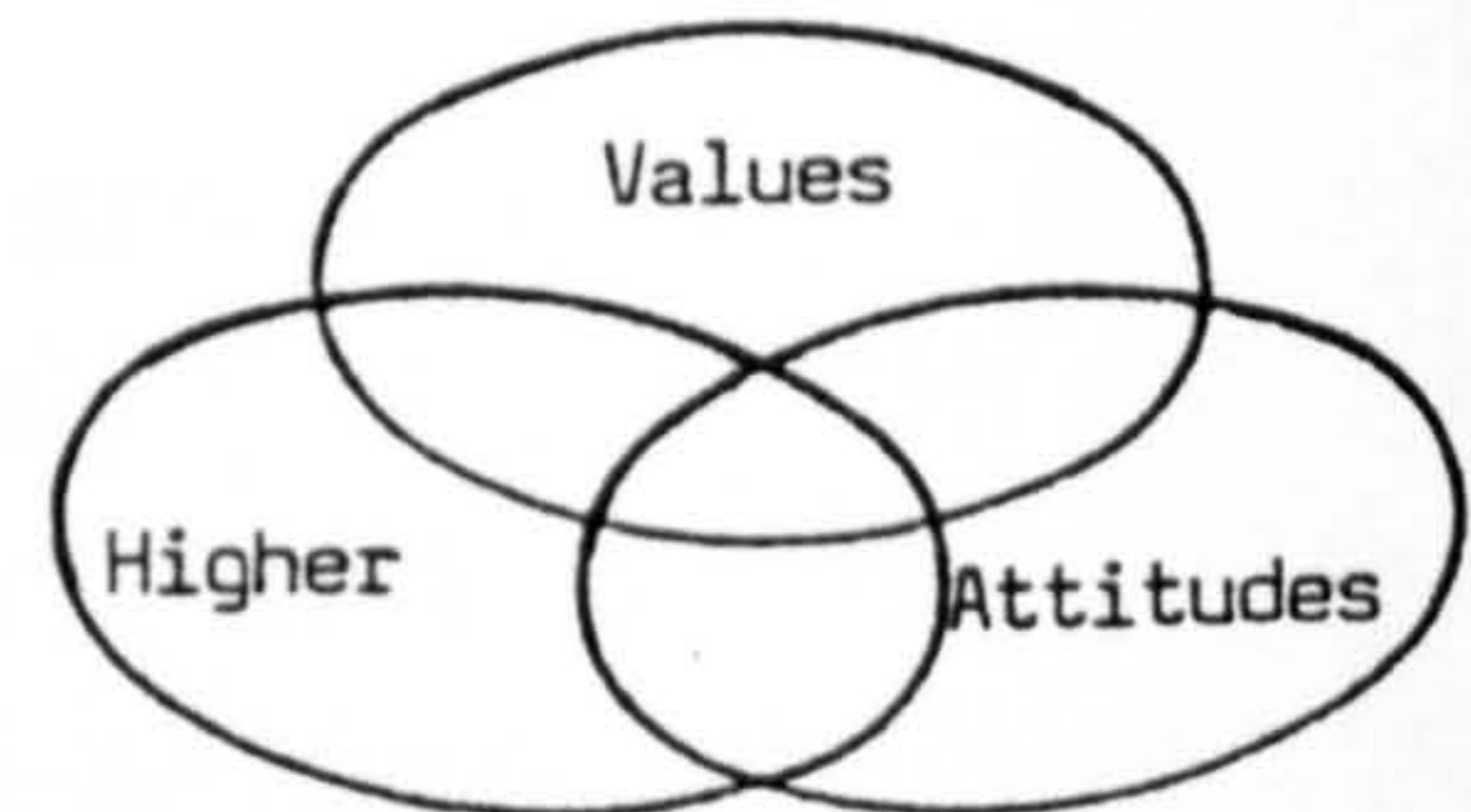
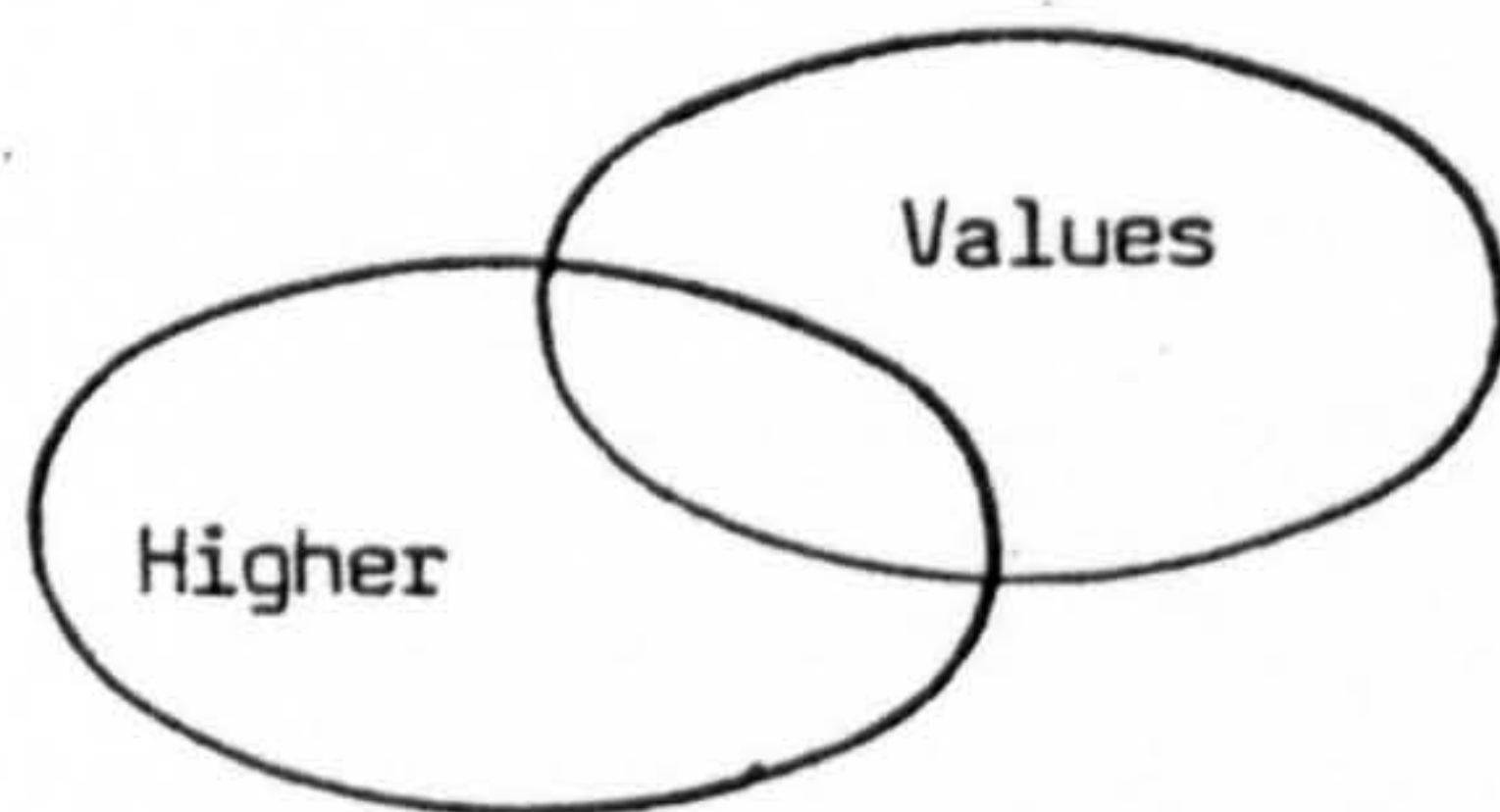
IDEAL

REAL

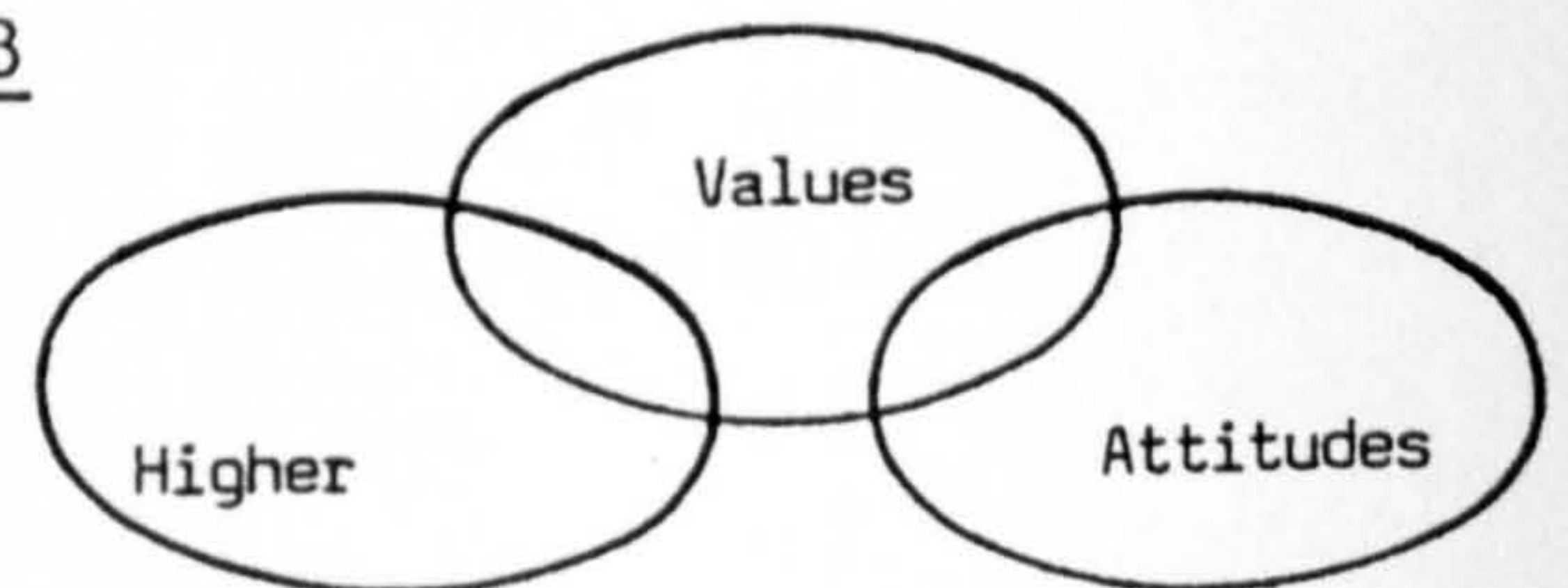
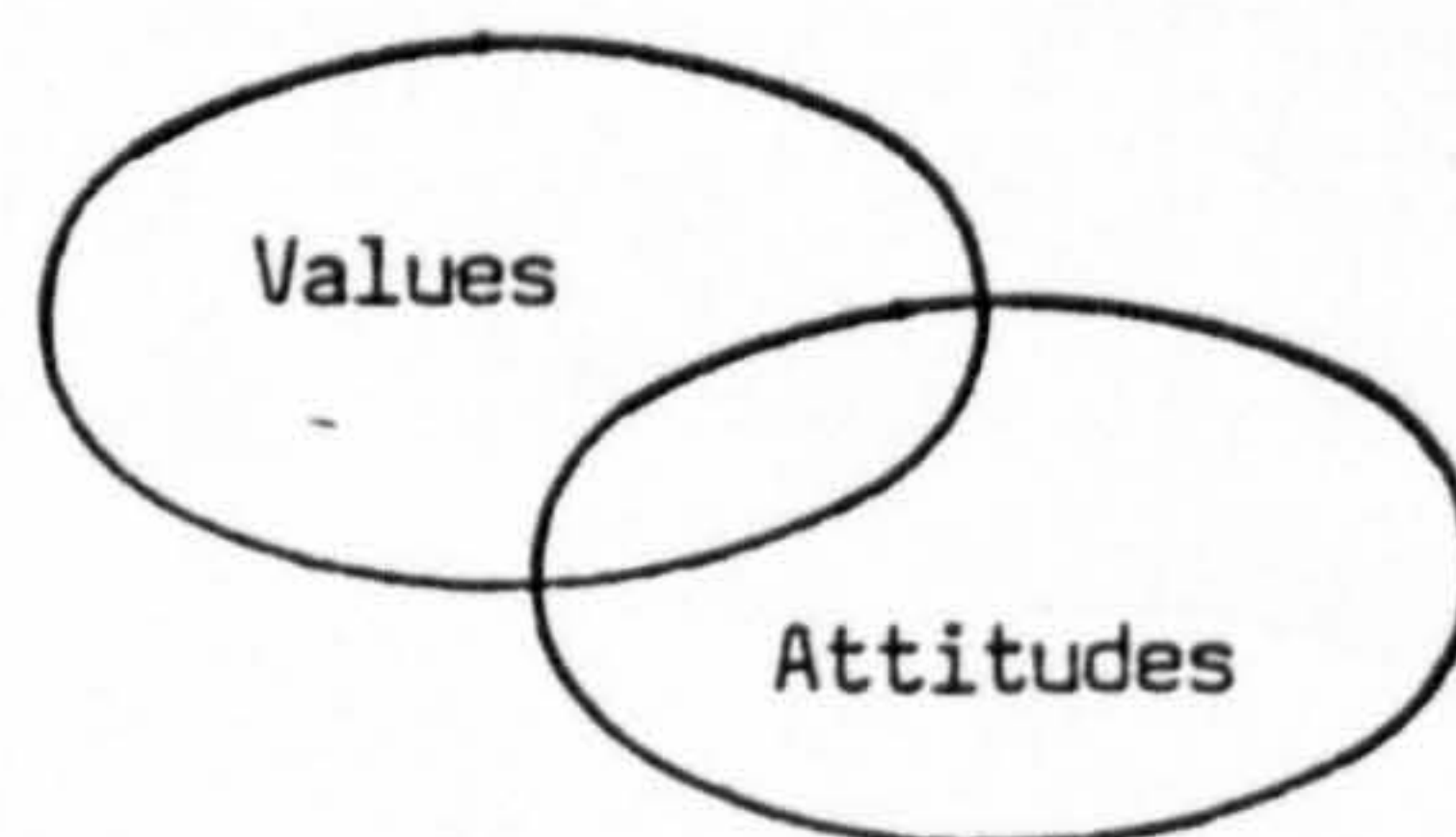
YEAR 1



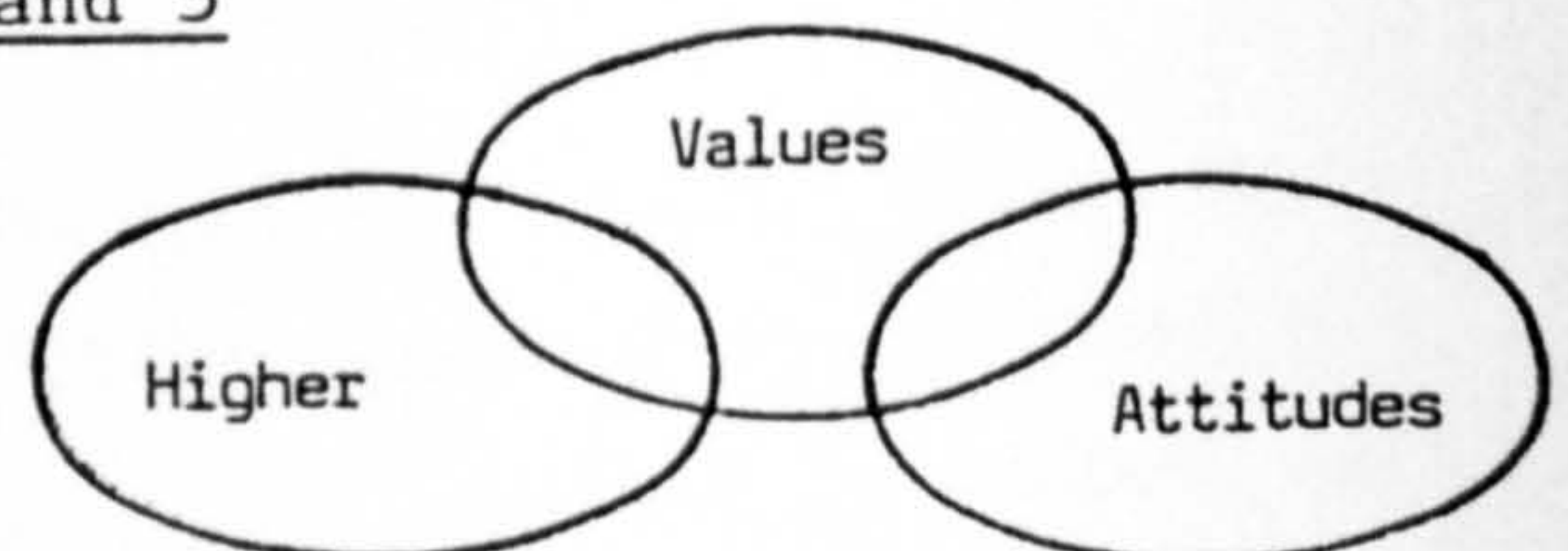
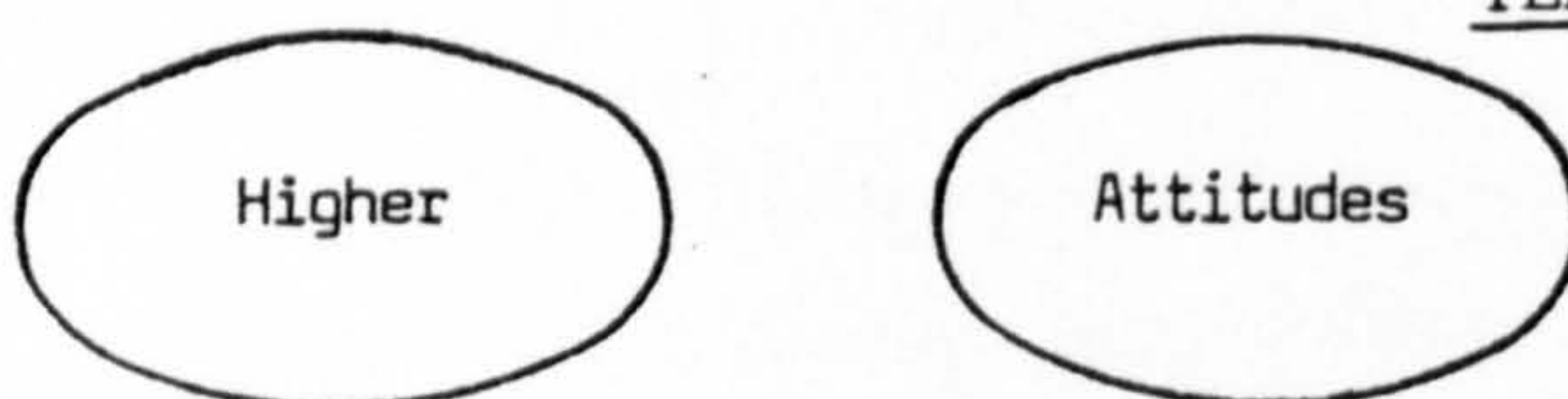
YEAR 2



YEAR 3



YEARS 4 and 5





#### Year 1

There are strong associations between Higher Order and Values and between Attitudes at Work and Values.

When Visual, Verbal and Knowhow models are examined, Year 1 reveals no association between Visual and Verbal in REAL and this distinguishes it from all other Years.

#### Year 2

There is a retrenchment and Attitudes at Work diminishes in salience to give the stress on Higher Order and Values - an abstract approach as concepts are acquired in an intellectual fashion.

#### Year 3

The reality principle comes more to the fore as actual experience is acquired and Attitudes to Work regains importance in the conceptual model.

#### Post Graduates

For Postgraduates which form a distinct subgroup, although little information is available as to the selection process involved in its formation, Attitudes to Work is still important and so is Higher Order, but there is no necessary association between these two domains.

#### All Years

With Higher Order Attitudes at Work and Values REAL the first two Years exhibit strong associations between all domains. It is however a moot point what actual experience of real Design they have had to this point. After these first two years of the course the Student model converges to that of the Lecturer.



SCHEMATIC SEMANTIC DIAGRAMS - YEAR OF COURSE

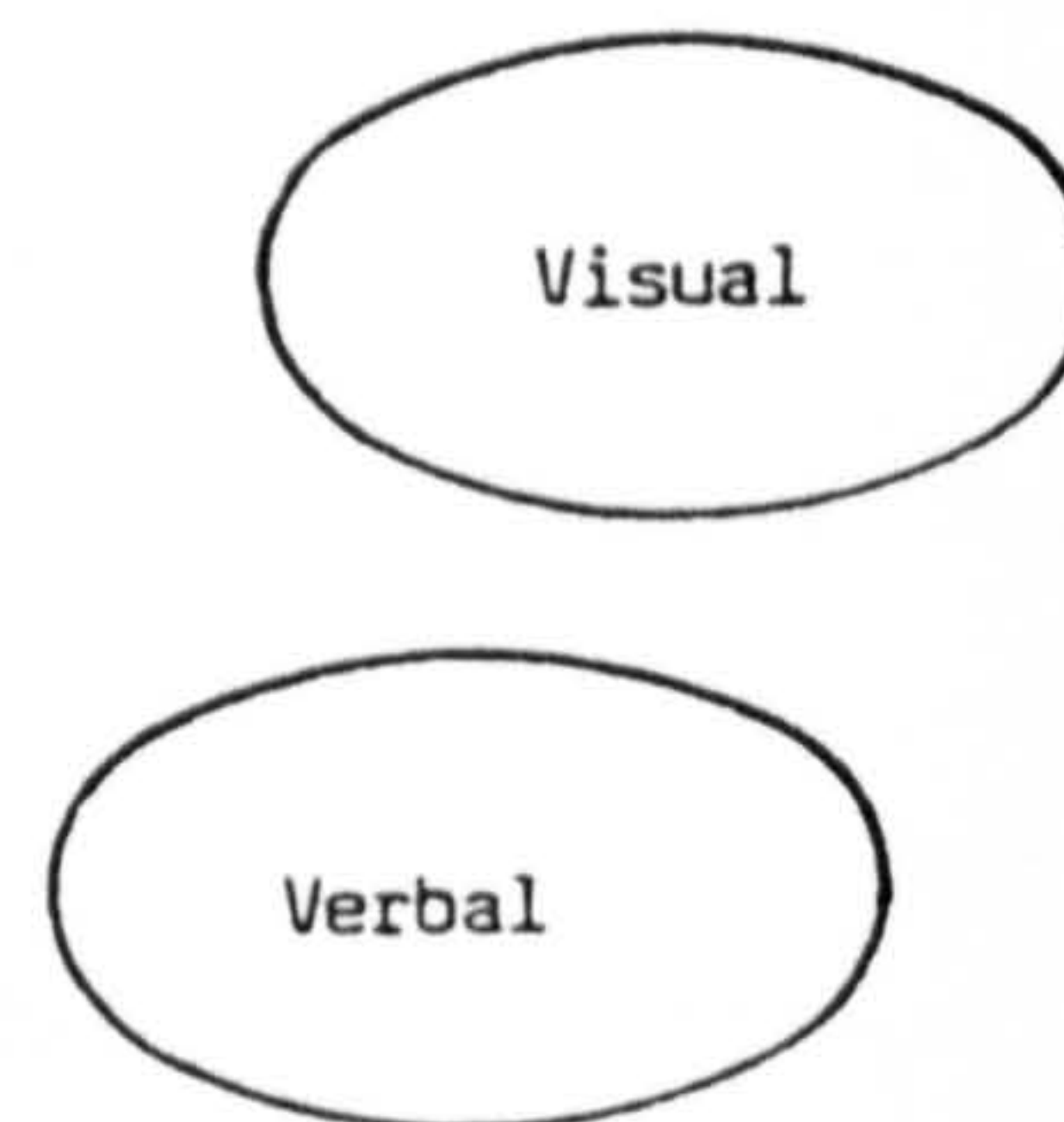
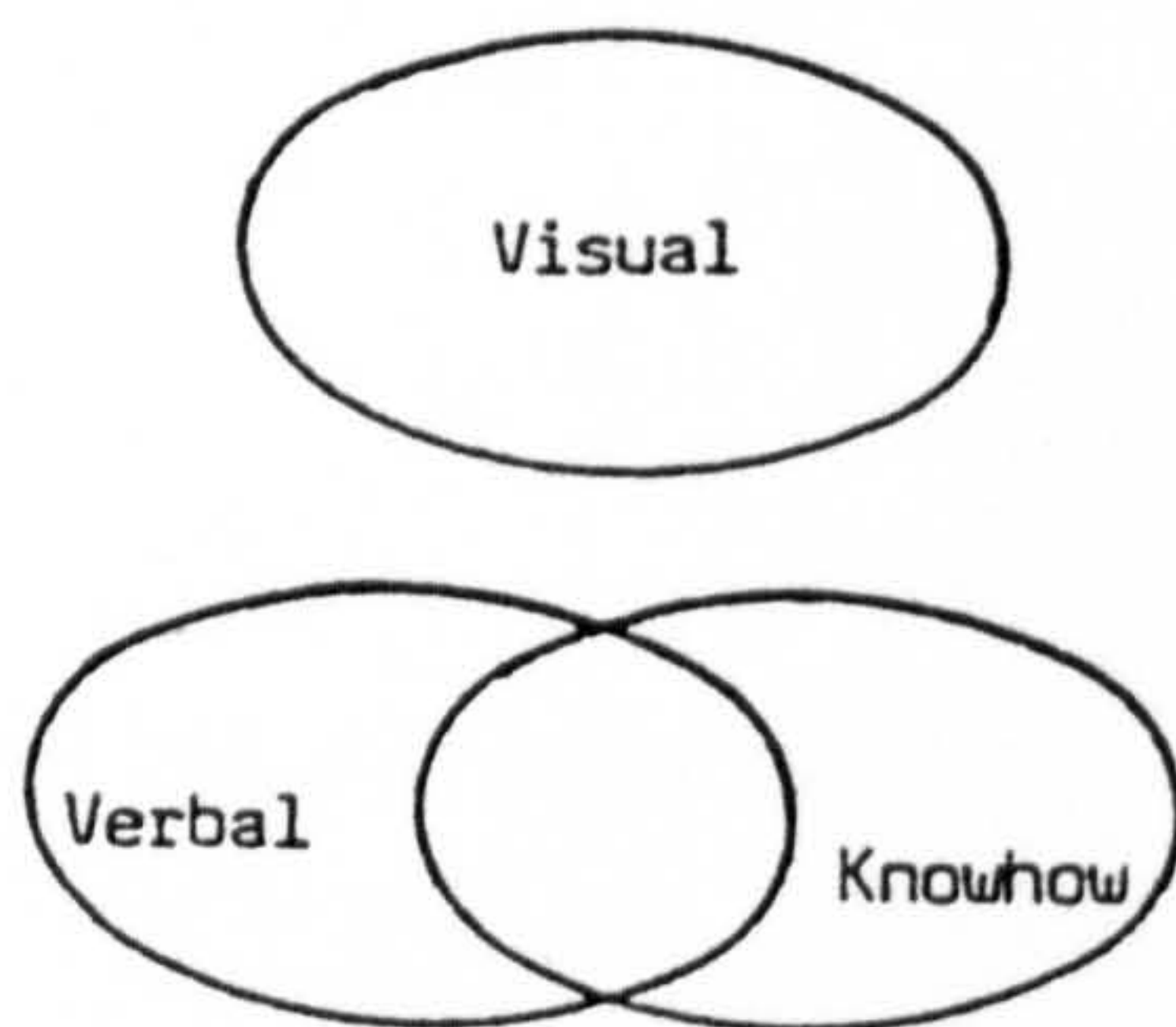
To show the semantic overlap or distinction between  
each Year of the Course

Visual, Verbal, Knowhow

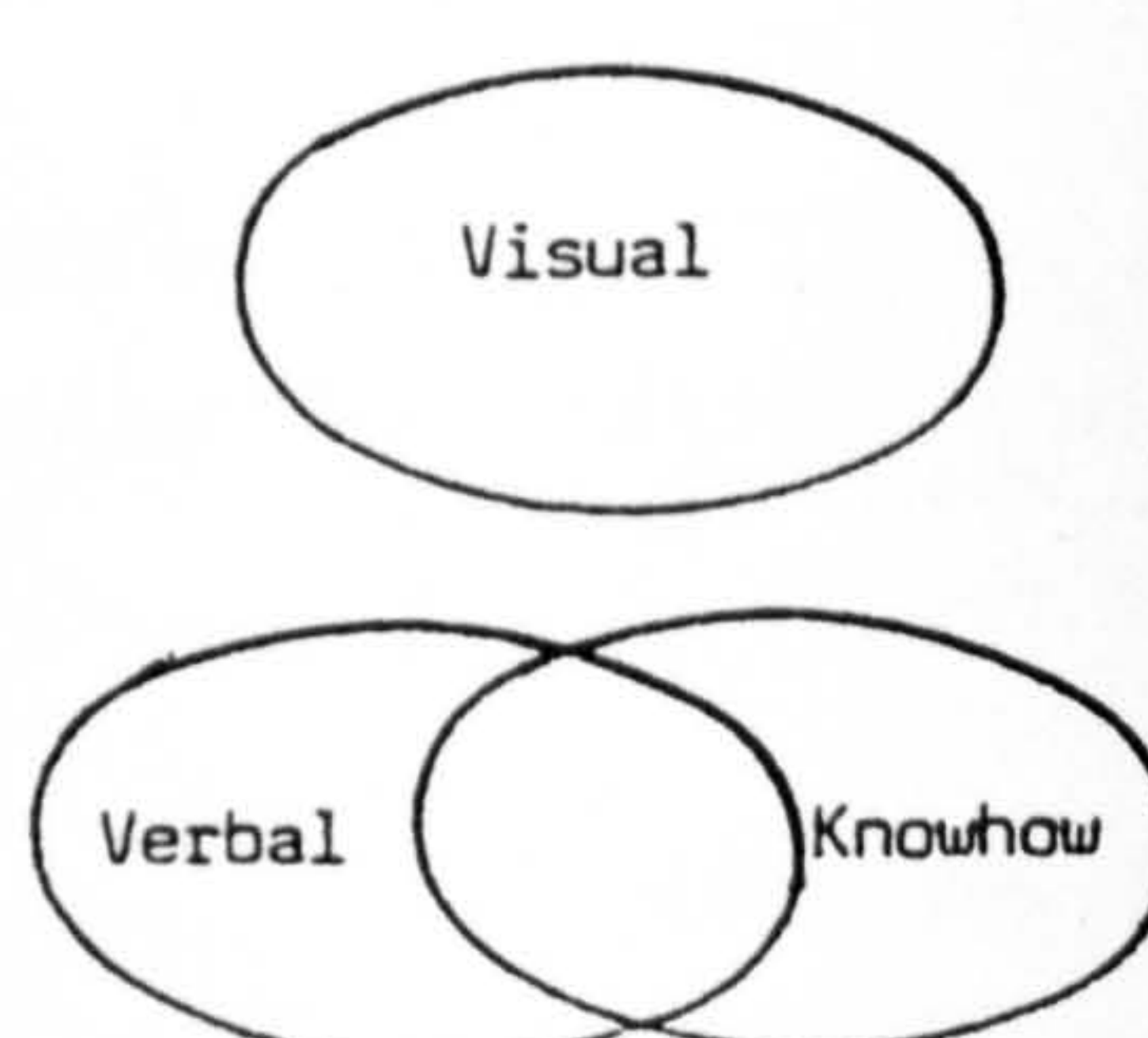
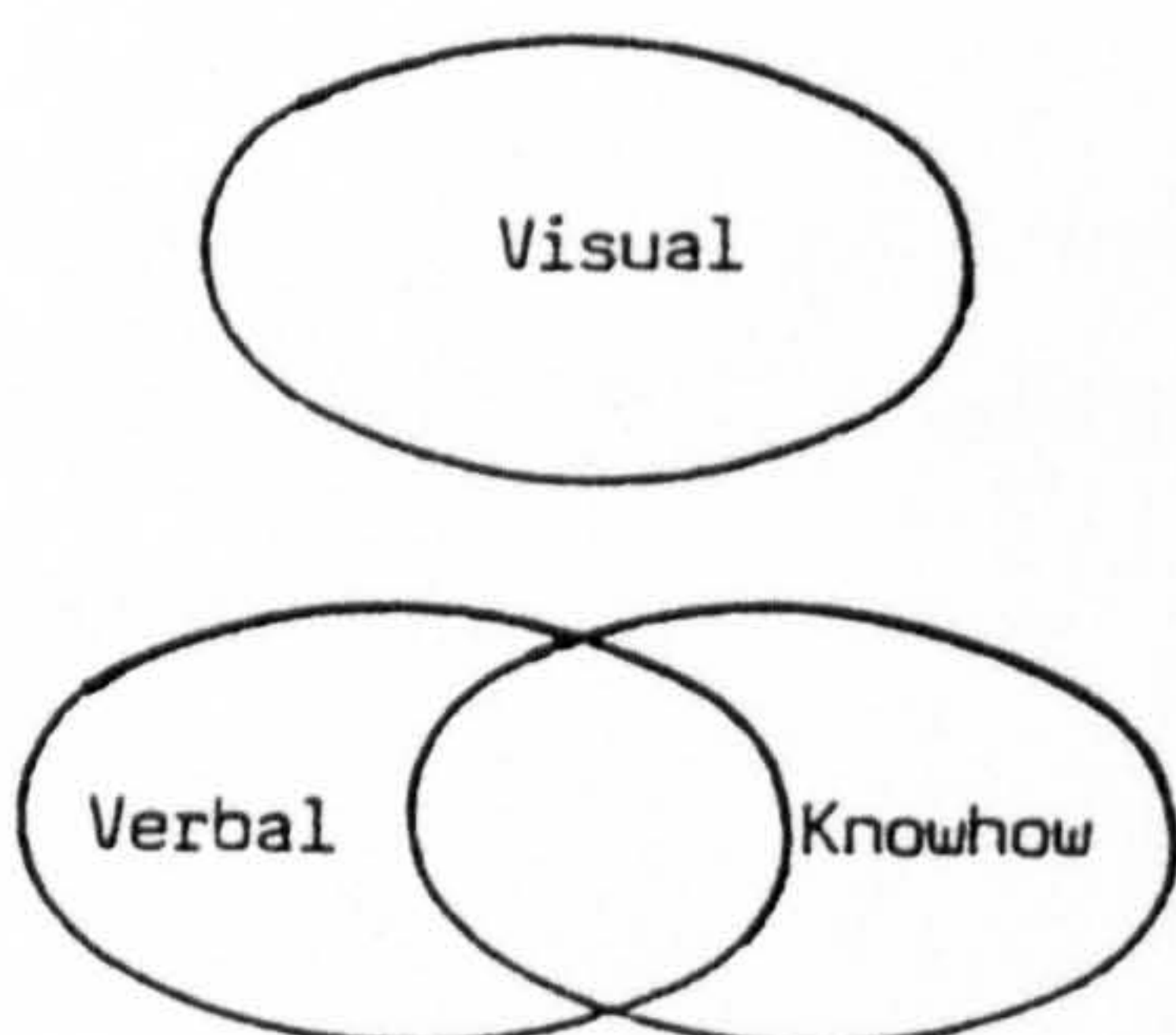
IDEAL

REAL

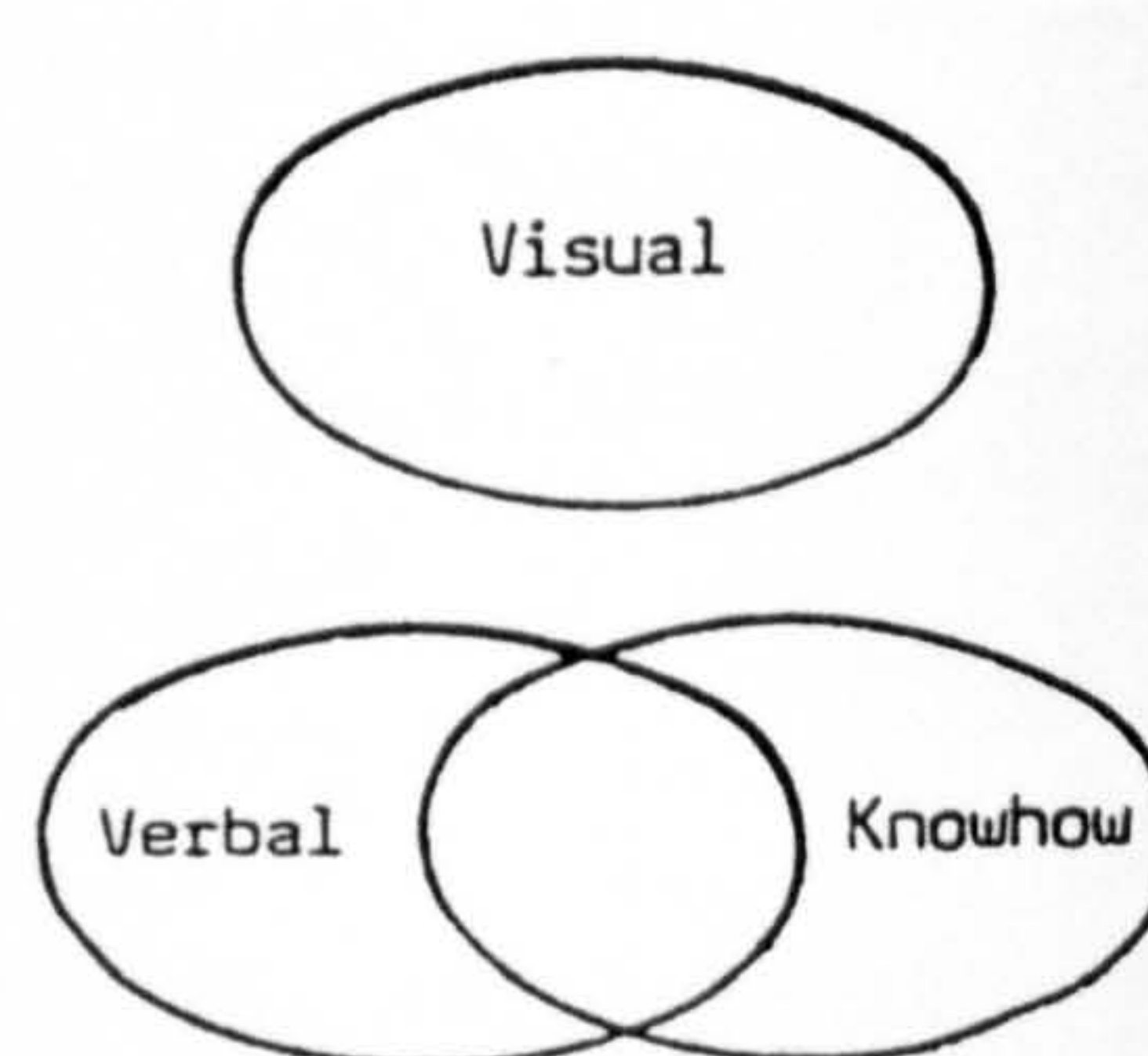
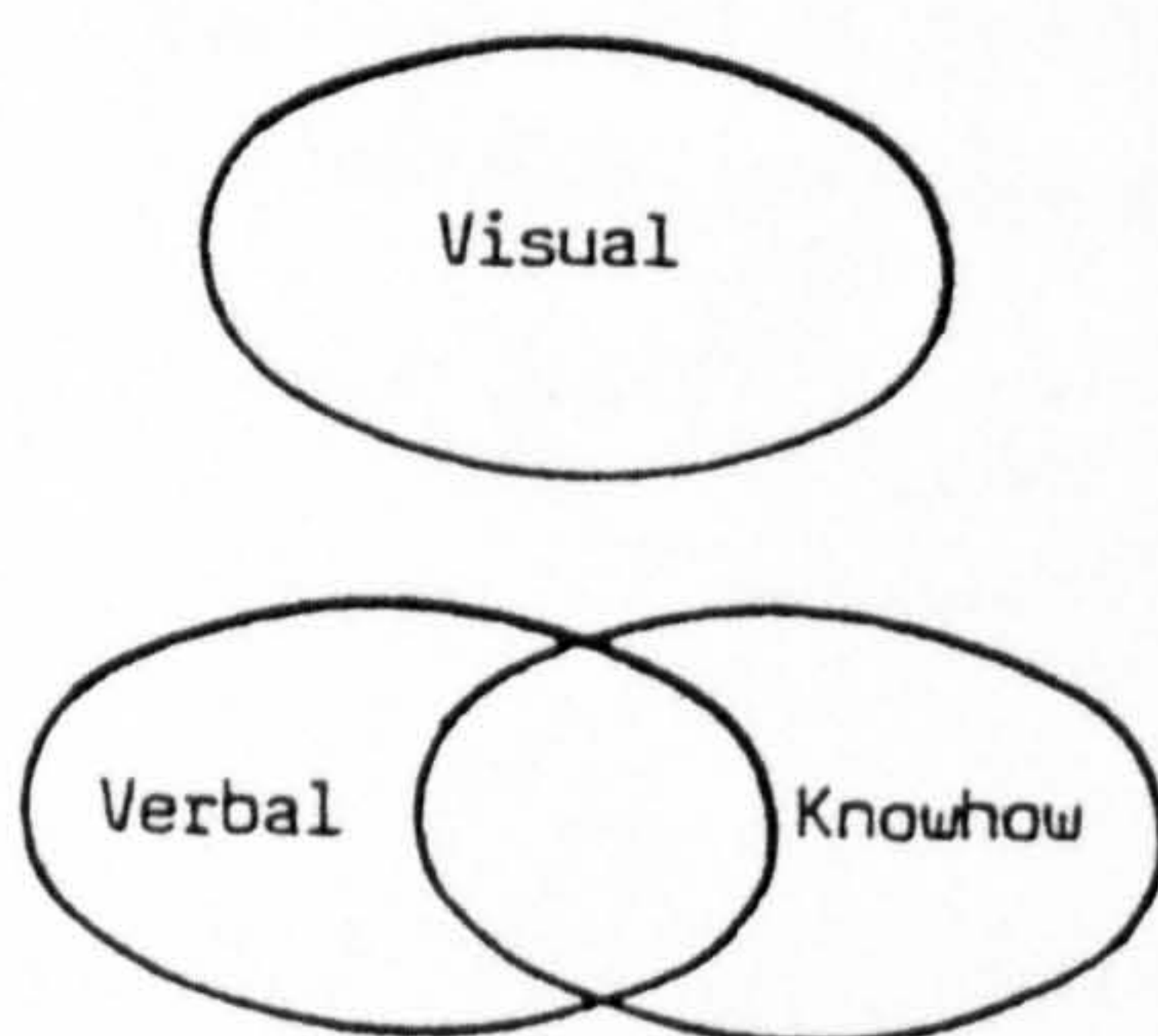
YEAR 1



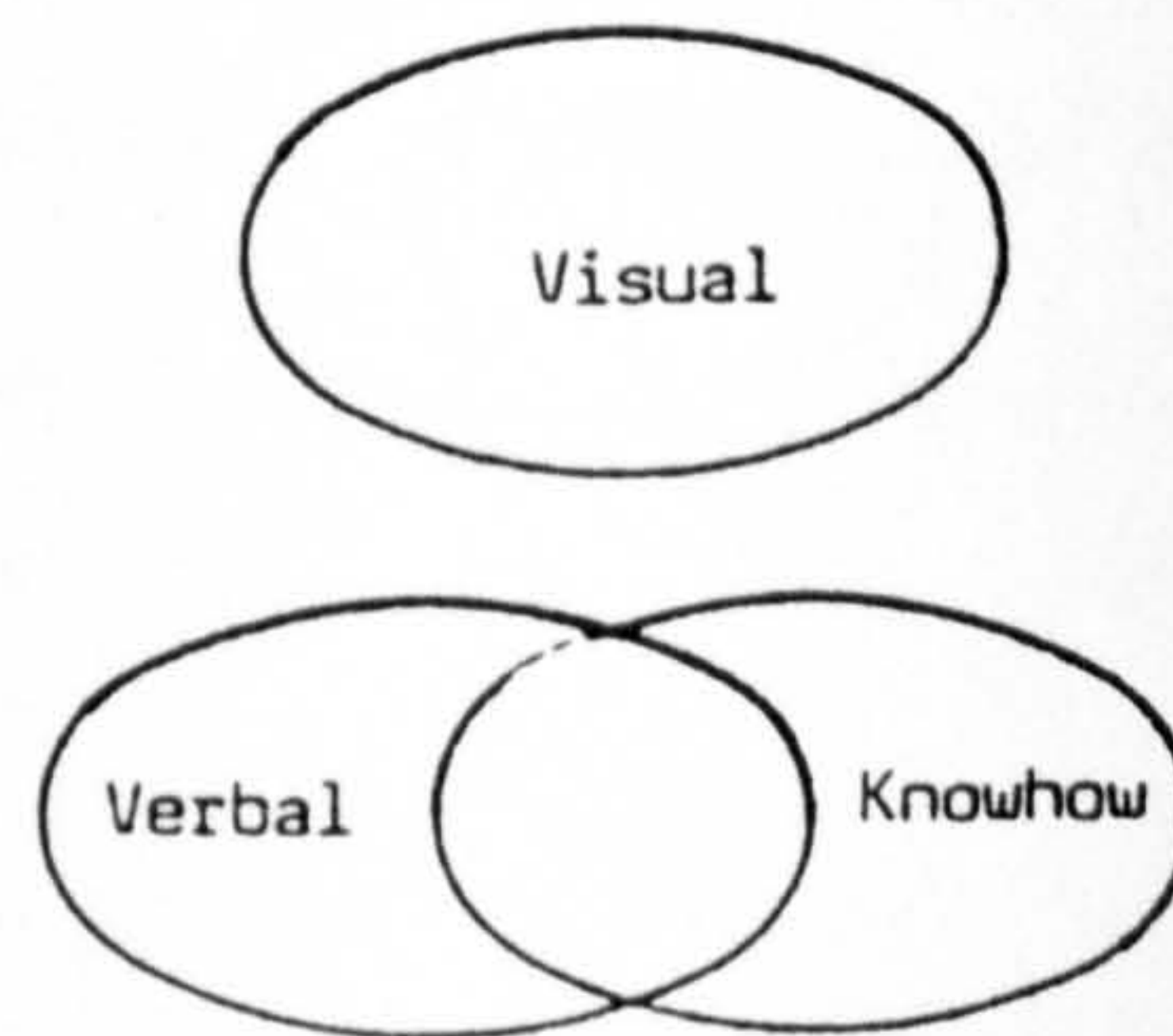
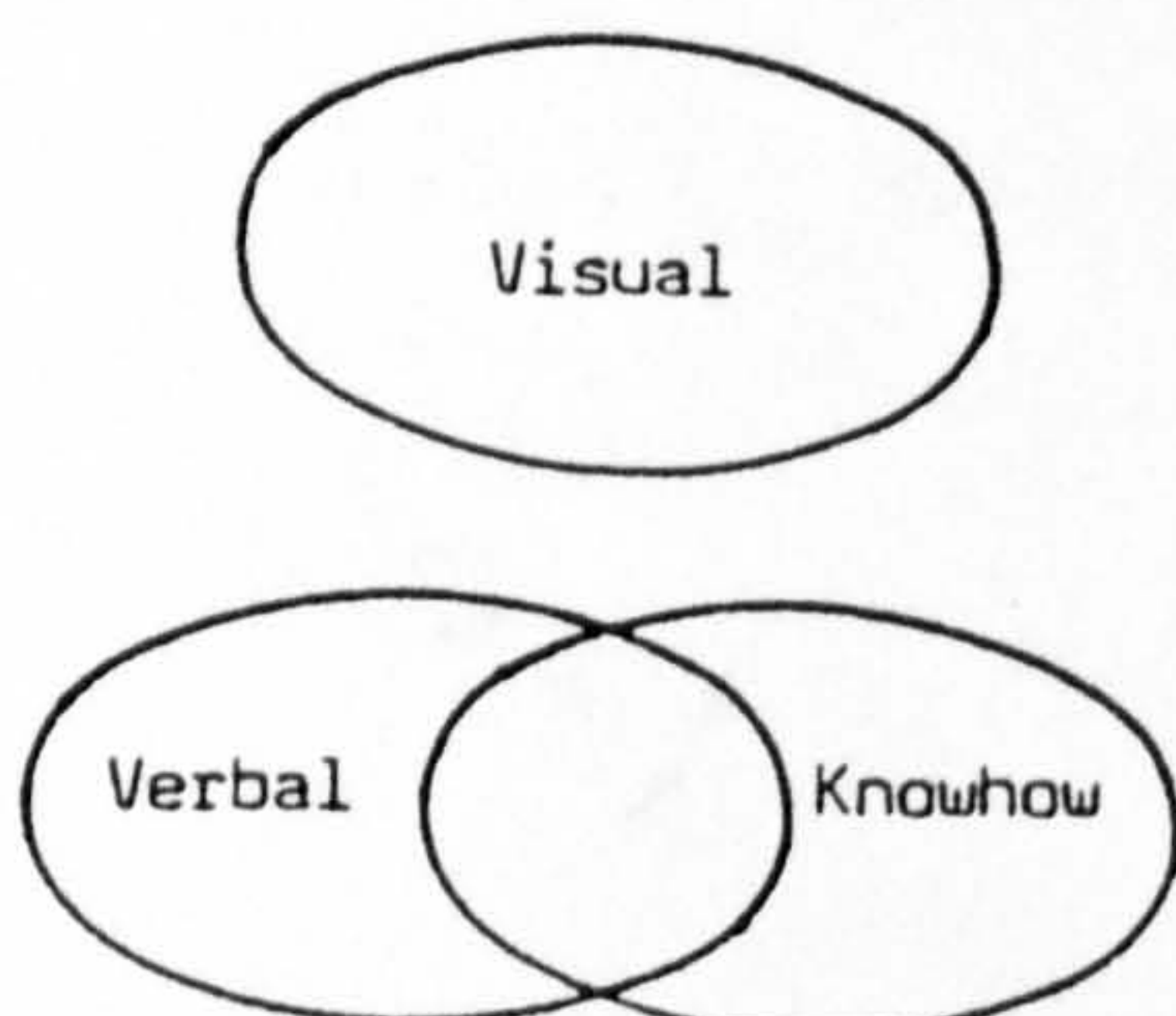
YEAR 2



YEAR 3



YEARS 4 and 5





So far as Visual, Verbal, and Knowledge & Knowhow are concerned, the same model obtains in IDEAL in all Years, with Visual as an independent domain and associations between Verbal and Knowhow. These associations grow weaker as the course proceeds.

In REAL Year 1 reveals a model in which Verbal and Visual are not associated. Thereafter in the course this model is replaced by the same as shown in IDEAL.

#### 10.4.1 Implications - Years

The fact that there is a systematic accommodation to the Lecturer model as the course progresses is perhaps not surprising. It points to an effective process, but still leaves unanswered the problem that the Lecturer model, per se, is not congruent with that of the Manufacturer.

A number of studies have been directed to the effect of training in Art and Design. Of these, most deal with responses to visual stimuli in the field of Fine Art (O'Hare 1976) and relatively abstract aesthetic stimuli such as colour chips (Nayatani 1970), polygons (Eisenman & Coffee 1964; Munsinger & Kessen 1964; Eysenck & Castle 1970).

Of more direct relevance to the present study, since it deals with Design training, is research by Whitfield (1982), comparing a group of Design students with a non-Design group and examining the systematic convergence over the years of course by the former group to the Lecturer view. The aesthetic preferences of Design students towards objects of design - in this case various designs of chairs - converged strongly to the Lecturer as the course progressed, and this is not altogether surprising. What was surprising was the strong reverse trend in the non-Design group.

The findings of the present study in the conceptual field of Design thus parallels what has already been demonstrated in the more strictly aesthetic.

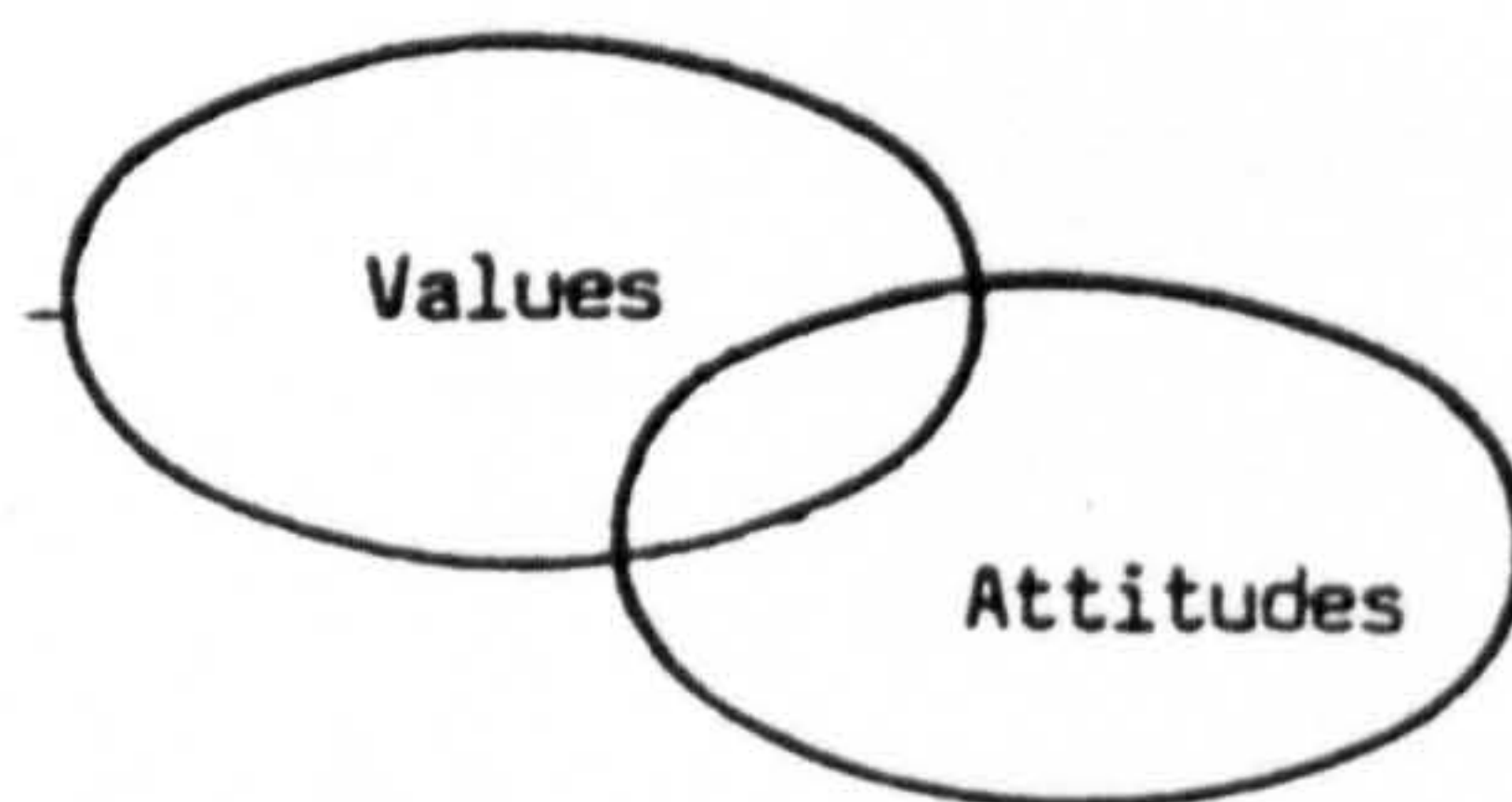


SCHEMATIC SEMANTIC DIAGRAMS - CLASS OF DEGREE

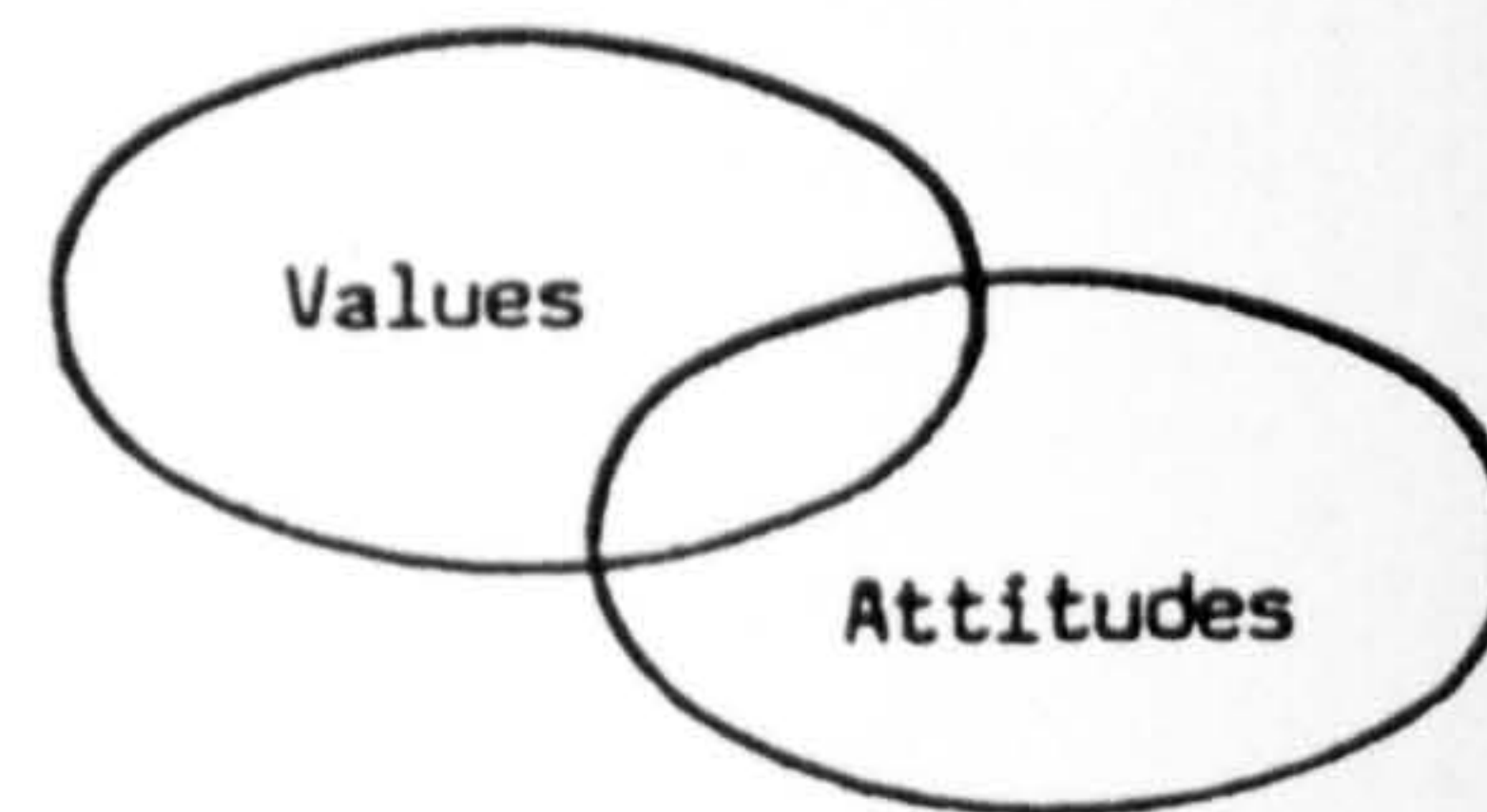
To show the semantic overlap or distinction between  
 "Upper" and "Lower" Class of Degree for B.A. Design

Higher Order Abilities, Attitudes at Work, Values

IDEAL

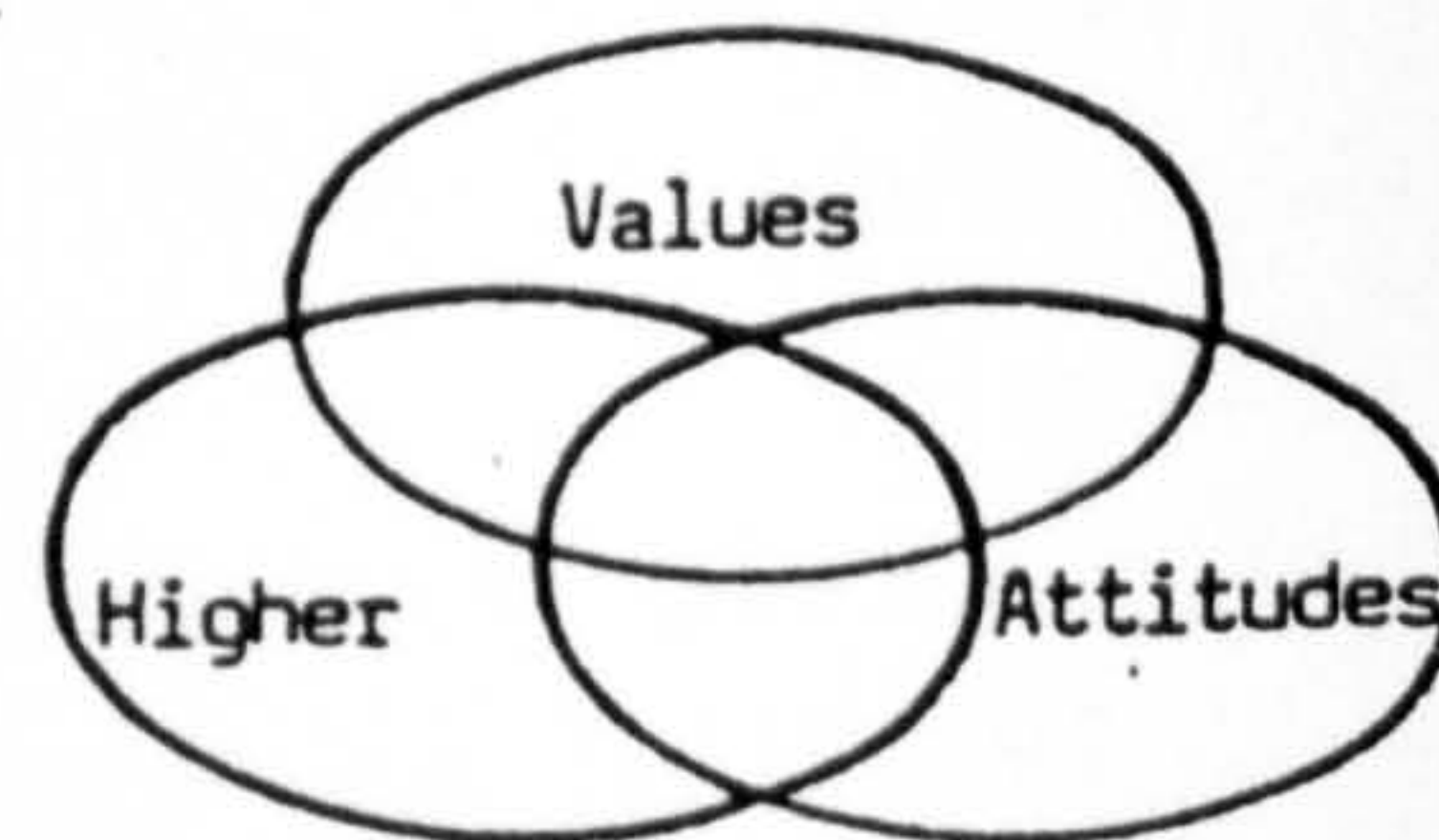
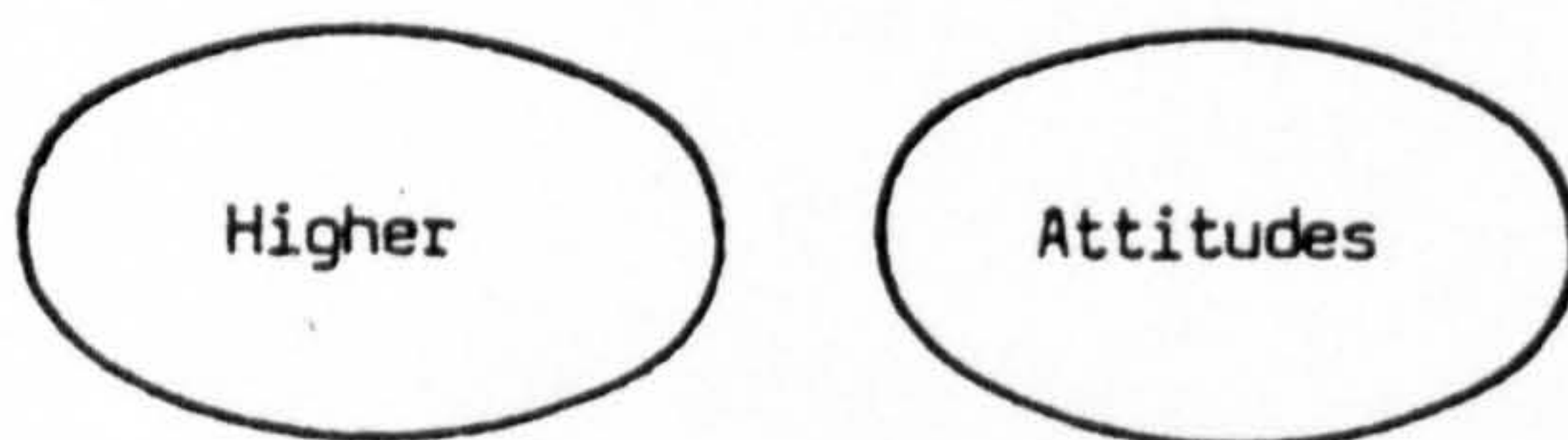


REAL



"UPPER"

"LOWER"





The gap however between Polytechnic and Industry remains to be bridged. From the Polytechnic side efforts could be intensified to enrich the course with actuality - to descend from what may be called the Redbrick tower. This may be done by importing more experience - more occasional seminars by industrialists, more part time Designer/Lecturers as happens in London. It may also be done by sending students out more, possibly insisting on very thick sandwich courses, monitoring them with more conviction and more incentive in the workplace, enlisting the hearts and pockets of Manufacturers by asking them to be Industry Tutors and paying them for the task. There is nothing like paying people for them to feel involved and be involved.

It could also be accomplished on a more theoretical level by stressing the importance and the relevance of methods used in industry and above all by training students in presenting themselves and achieving insight into themselves and others that they will have to work with as a member of a team of experts.

This enrichment to the course could well be accomplished in two stages:

At the very beginning of the course to mitigate some of the unrealism found there.

Towards the middle of the 3rd Year when the actual content of the course has been mainly acquired and it can be measured against external experience.

#### 10.5 Class of Degree

Differences in model between "Upper" class of Degree - that is First and Upper 2nd, and "Lower" class - that is Lower 2nd, Third, Referred and Fail - centre on two aspects:

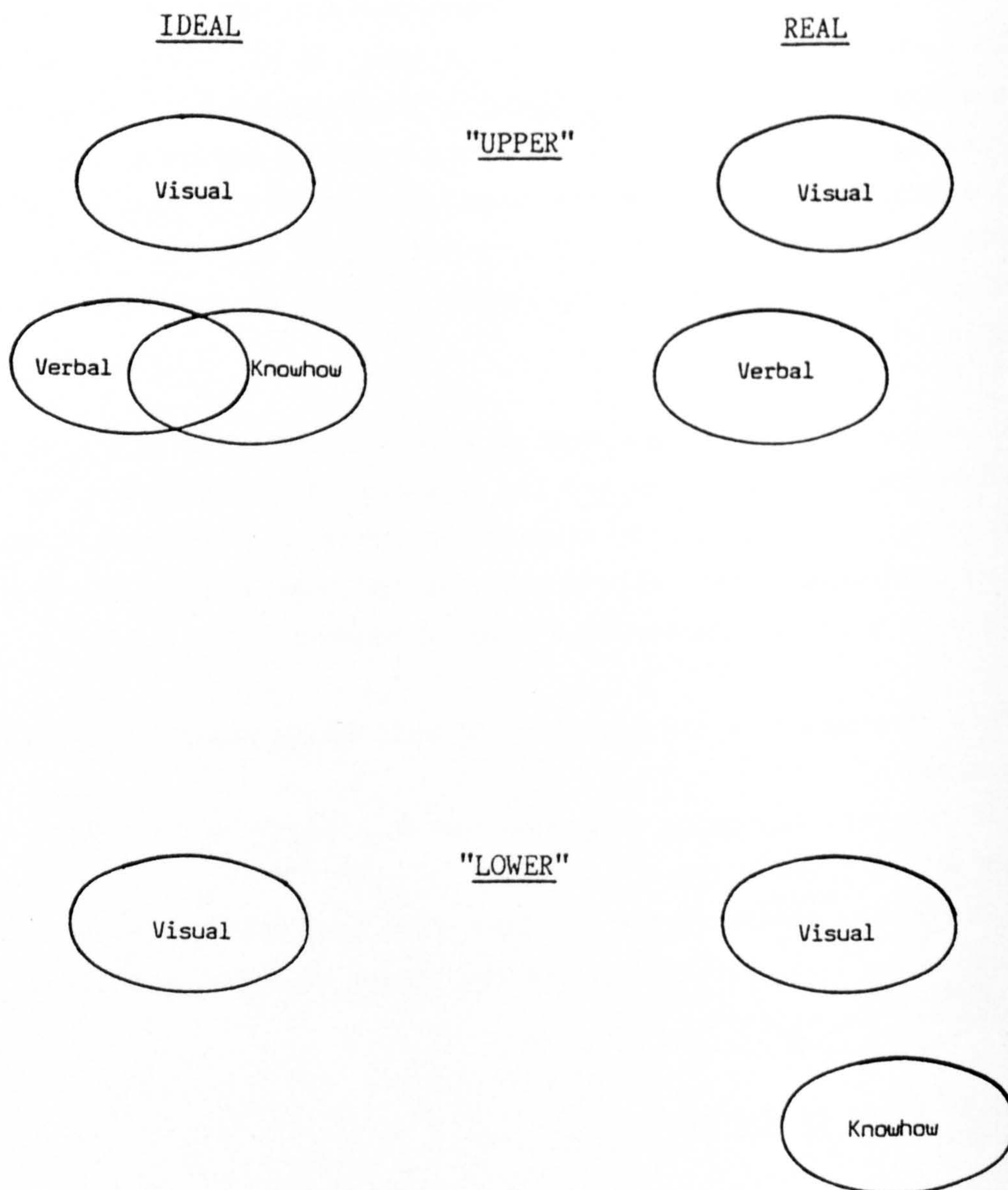
Higher Order Abilities  
and  
Verbal Presentation Skills



SCHEMATIC SEMANTIC DIAGRAM - CLASS OF DEGREE

To show the semantic overlap or distinction between  
 "Upper" and "Lower" Class of Degree for B.A. Design

Visual, Verbal, Knowhow





On the face of it the model for Lower degree Class contains a Higher Order component whereas that for Upper degree Class does not. This is because in Upper degree Class scores for Higher Order are distributed equally above and below the median. In Lower degree Class by contrast the distribution is unequal with the majority of scores for Higher Order below the median. There is therefore an association but it is a negative association on a par with a negative correlation.

Verbal Presentation includes both written and oral skills and in Upper class of Degree is seen to form part of both IDEAL and REAL models. It does not however play a significant factor in the Lower class of Degree model.

It is interesting to compare models for Lecturers Designers and Manufacturers with those for Degree class.

IDEAL and REAL models Visual, Verbal and Knowhow for Lower class of Degree correspond well with that of the IDEAL for Manufacturers.

The REAL model Higher Order Abilities, Attitudes at Work and Values for Upper class of Degree is much like that for Manufacturers REAL.

Both IDEAL and REAL for Upper class of Degree models are similar to those of Lecturers with the proviso that Higher Order enters into the Lecturer model, whereas it is perhaps not stressed (even taken for granted) in Upper class of Degree.

It would be reasonable to assume that those who in fact obtained an Upper class of Degree satisfied the examiners more than those who got a Lower class of Degree. To that extent therefore they reflect those attitudes and concepts approved by the CNAA.

Verbal facility, whether in writing examination answers, or whether expounding the merits of a design, using a combination of verbal and visual techniques, is of the essence for the CNAA.

It could however be suggested that while on the one hand Manufacturers are not content with standards of written presentation,



when it is a question of Designers submitting memos and reports direct and individually to management, they are equally not encouraging of verbal presentation or prowess when it is a matter of the Designer acting or aspiring to act as *primus inter pares*.

Without therefore necessarily expressing any value judgement it would seem that the priorities of CNAA and Manufacturer are to this extent mismatched.

Further investigation into other differences between the models of class of degree used data from the behavioural measures.

Models using scores from the Eysenck Personality Questionnaire showed no difference between Upper class of Degree and Lower class of Degree either in Neuroticism, Extraversion or Psychoticism.

Models however, using scores from the Solomons' Survey of Values, showed differences in model involving Theoretic, Pragmatic and Dominant values. Whereas the Upper class of Degree model revealed a saturated model with strong associations between each of these values, the Lower class of Degree model showed no associations and in fact the optimum model involved the Theoretic value but in a negative sense as with Higher Order above.

This would point to a system in Upper class of Degree whereby situations - including Design situations - would be evaluated globally and in perspective. This would be a creative and fertile approach to solving design problems and it might be plausible to draw parallels between this and the communication and interpersonal situation involved in Verbal presentation.

#### 10.5.1 Implications - Class of Degree

It would seem that the main divergence between Graduates and Manufacturers is in the matter of Verbal Presentation, and to a lesser extent in the matter of Higher Abilities.

On the one hand Manufacturers complain about the standard of written presentation. This may in fact be a question of formal illiteracy - uncouth and illspelt presentation. Permanent records of transactions, decisions, suggestions are important in business matters. On the other they are reluctant to approve oral presentation, presumably because it would enhance the role of the Designer and hence his control over the entire Design process.

In the REAL world Manufacturers admit the existence of Verbal Presentation but see it as discrete and not allied to Knowhow and Knowledge - a kind of emasculated Verbal Presentation.

The model of the Upper Class of degree is therefore further removed from that of the Manufacturer than is the Lower.

As to Higher Abilities, the Manufacturers include it in their IDEAL model, but do not perceive it in the REAL one. They recognize the value of creative, higher level approaches to Design, but are anxious about letting the Industrial Designer rule the roost. The two sides of the creative coin are however inseparable - the creative impulse which is by definition solitary, and the cyclic elaboration and modification of that impulse as a result of comment and criticism and intercourse with other experts.

What is at issue is how to effect a compromise between the "better" students and the Manufacturers. The implication again would seem to be to provide insight - enlarging the tunnel vision of the Manufacturer, and subduing the ebullience of the Student. This again might be seen to have some effect on the potential creativity of Design and the consequent merchantibility of products. The whole system of Design from conception to delivery on the market may be seen as interdependent - a system of ecology. Tampering with any one part may have unforeseen consequences on the whole. What seems to be required is enlightened self-interest.



## 10.6 Institutions

On the following pages Diagrams 28 and 29 present schematic models for Institutions. In Higher Order, Attitudes and Values London shows both in IDEAL and REAL weaker associations between the domains. The London REAL model bears close resemblances to that of Manufacturers and also to the Upper Degree class subgroup.

In Visual, Verbal & Knowhow IDEAL models bear resemblances to IDEAL models of Lecturers, Industrial Designers and Manufacturers. In REAL however only London is similar to Lecturers, Designers and Manufacturers.

### 10.6.1 Implications - Institutions

Interpretation of these models is problematic. London does seem to be different. Its REAL model converges more to that of Lecturers, Industrial Designers and Manufacturers. It is difficult to say on the available evidence however that this is a teaching or an Institution effect. It may be thought quite simply to be a metropolitan effect, a function of the life style of the London student which, while there is little campus life and discussion as such, nevertheless provides increased opportunities and artistic stimulus. The actual ethnic make-up of students may also be different together with the cultural input of such a mix.

On the other hand there is little doubt that London is the very centre of the Design world of the UK. By comparison with some of the provincial centres there is a very real choice offered to prospective students of Design, both in the number of Institutions and the slants and specialisms available. Students there are able to sample a whole range of exhibitions which may or may not eventually tour elsewhere.

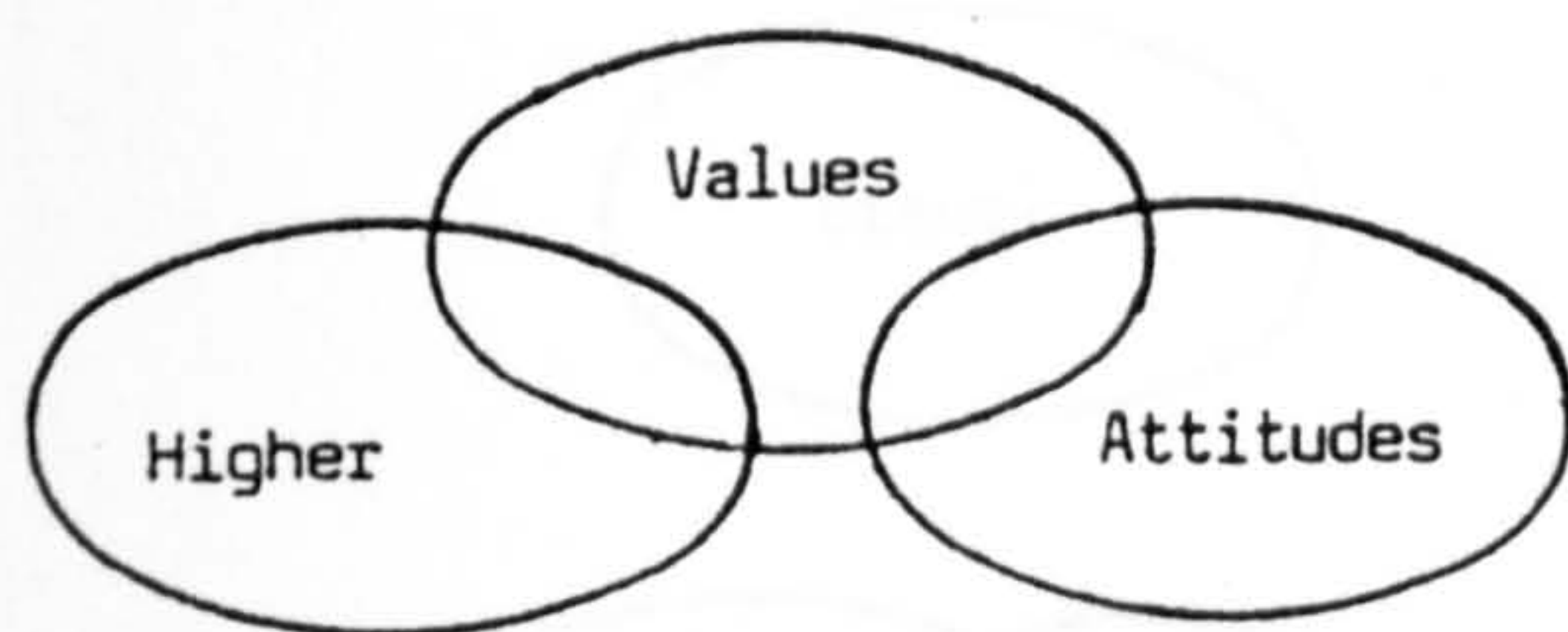
So far as the Institutions themselves are concerned they also benefit from the built-in attraction of the metropolis. There is a vast pool of practising Designers and consequently a vast pool of potential and valuable part-time lecturers for Design courses. It is a fact that a large proportion of courses in London Design Colleges are staffed by part-timers - by definition aware and

SCHEMATIC SEMANTIC DIAGRAMS - INSTITUTIONS

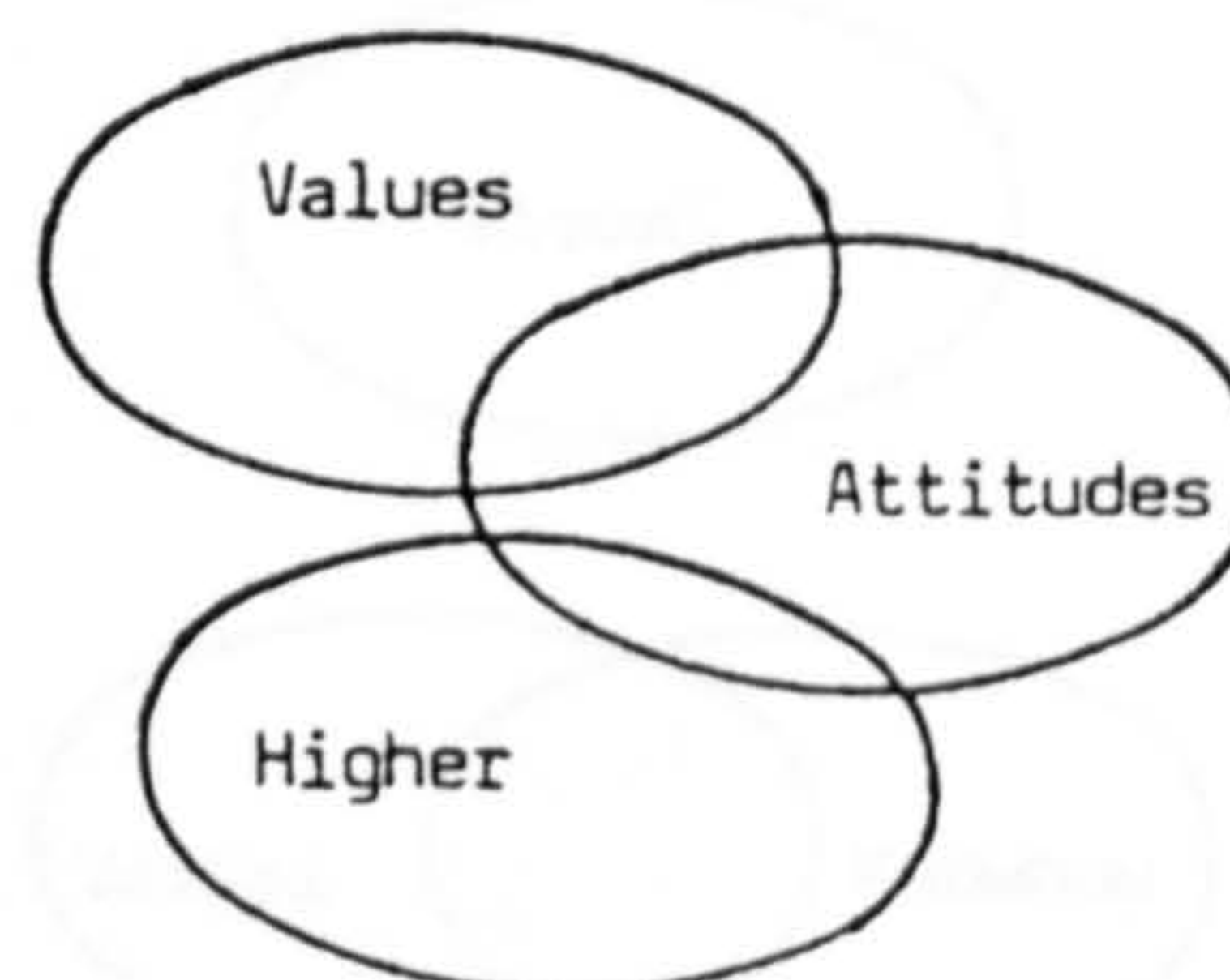
To show the semantic overlap or distinction between  
Institutions

Higher Order Abilities, Attitudes at Work, Values

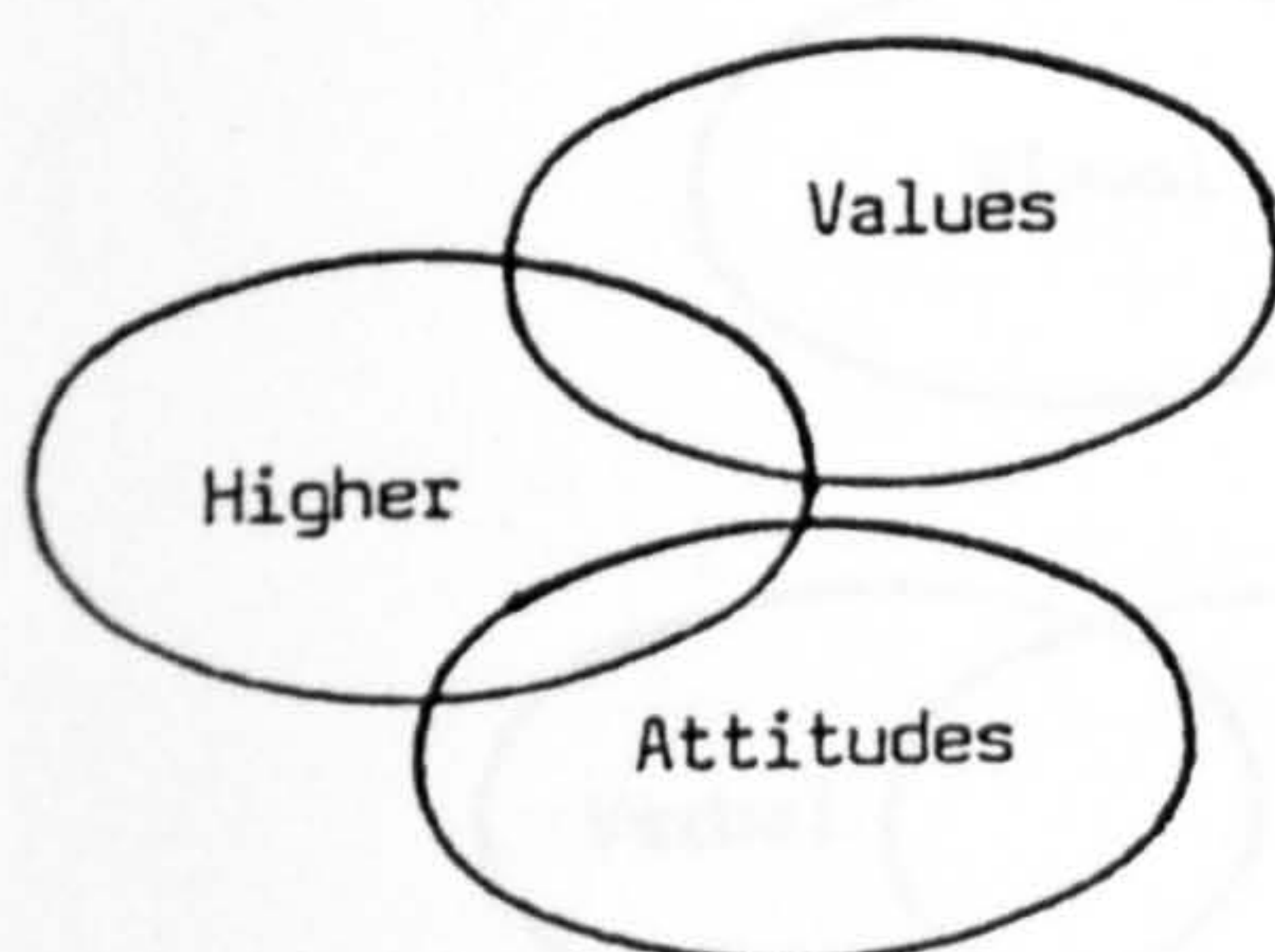
IDEAL



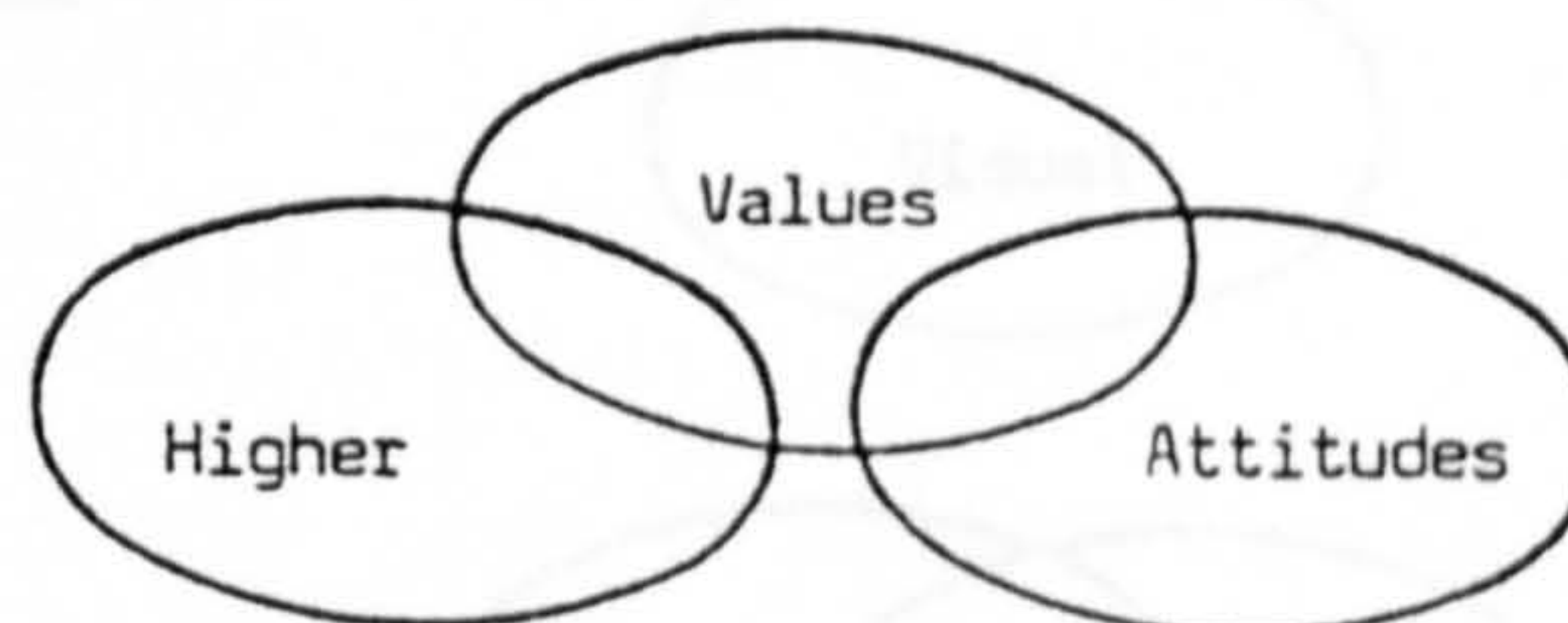
LEICESTER



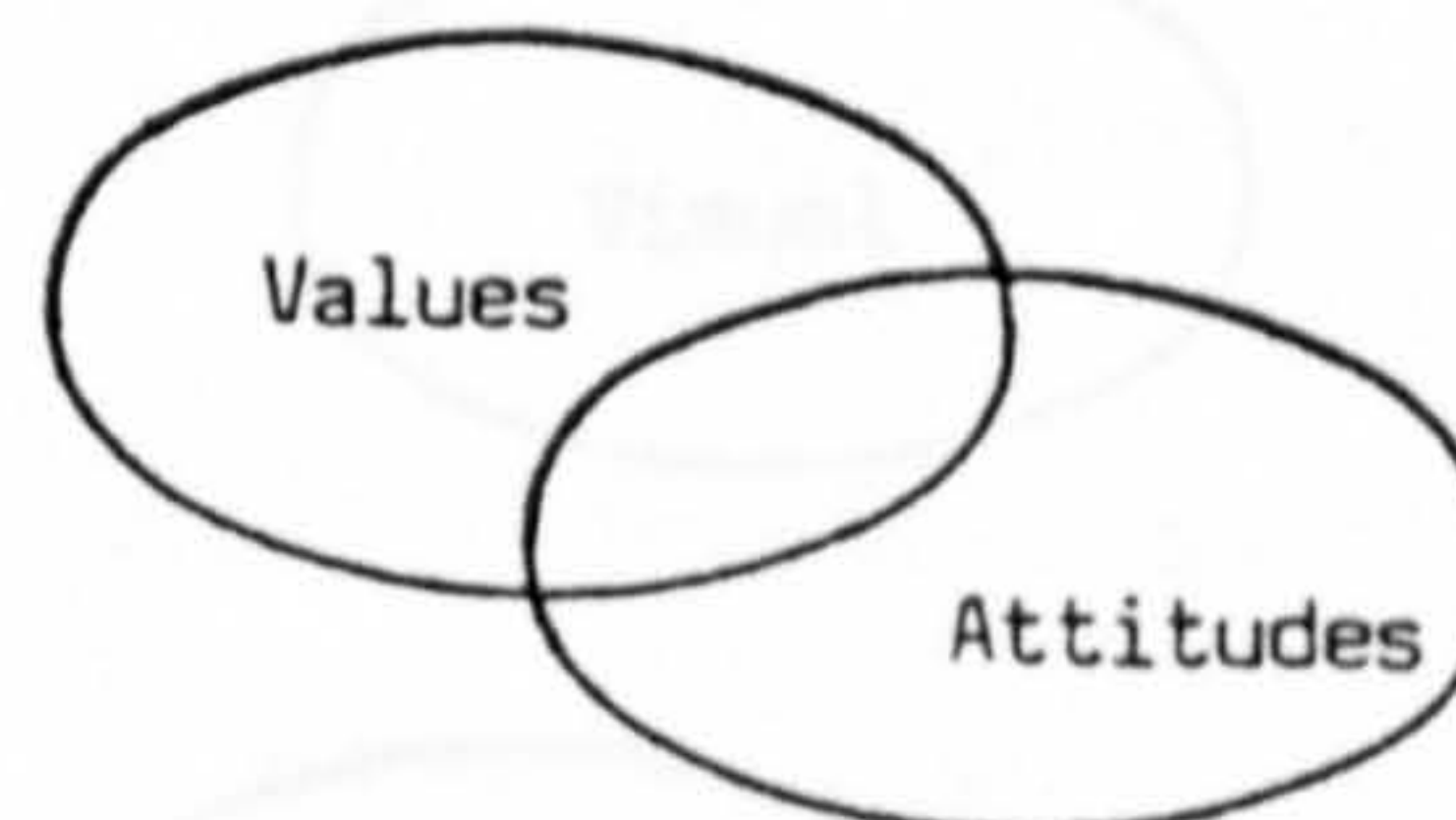
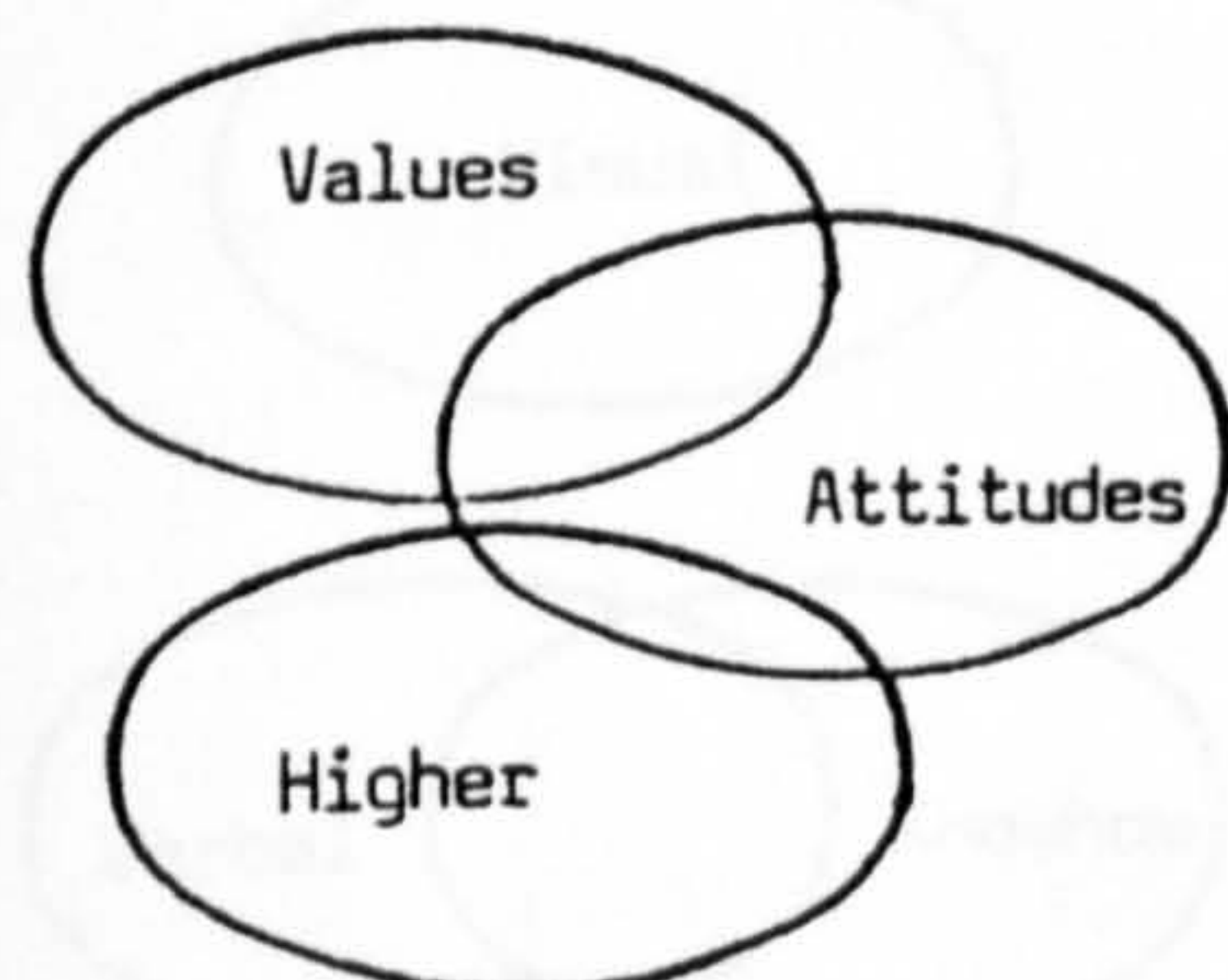
REAL



TEESSIDE



LONDON

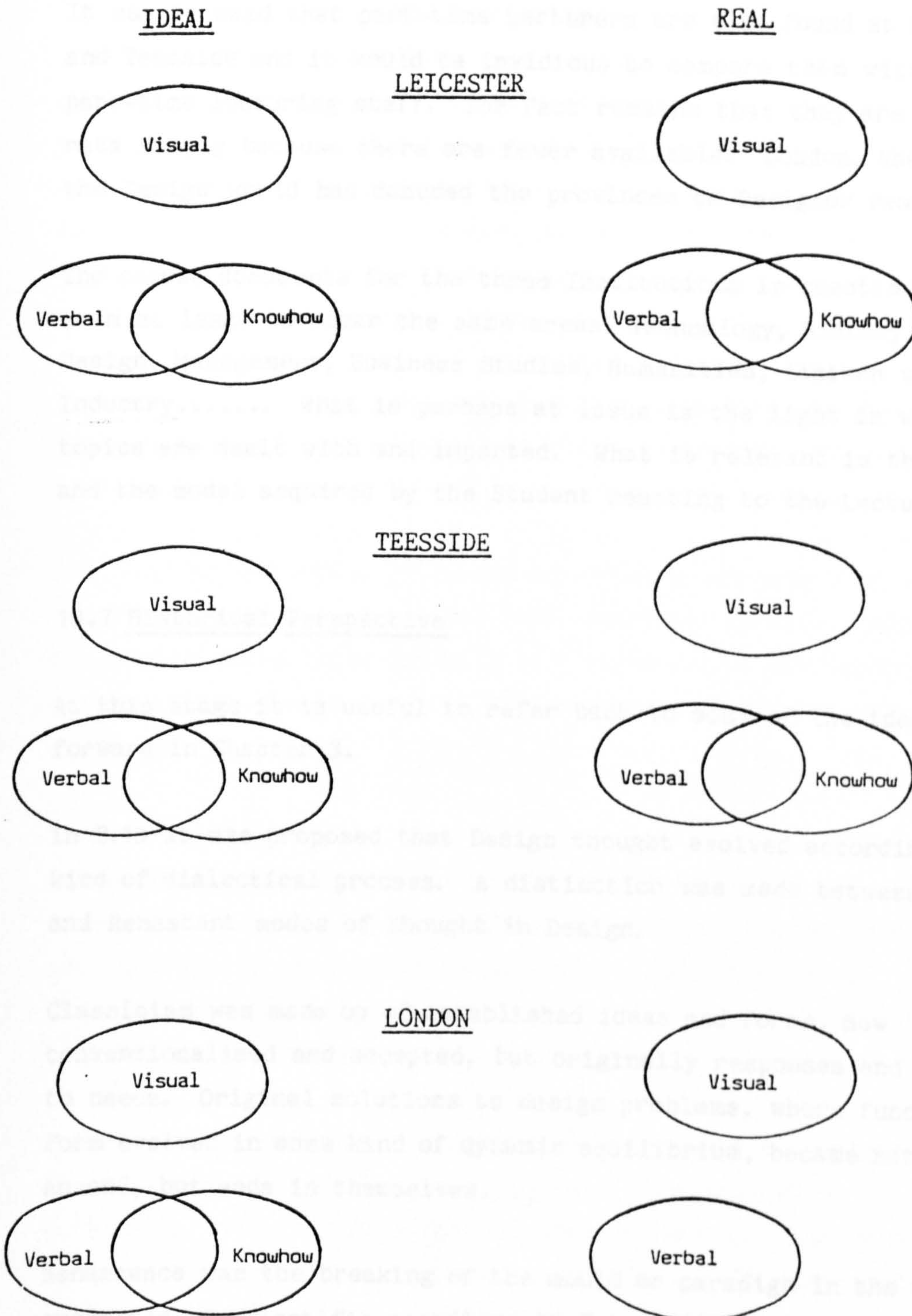




SCHEMATIC SEMANTIC DIAGRAMS - INSTITUTIONS

To show the semantic overlap or distinction between  
Institutions

Visual, Verbal, Knowhow



involved in the practicalities and niceties of commerce. This may well explain why the London student REAL model is closer to that of Designers and Manufacturers.

It may be said that part-time Lecturers are also found at Leicester and Teesside and it would be invidious to compare them with London part-time lecturing staff. The fact remains that they are fewer pro rata simply because there are fewer available. London, the centre of the Design world has denuded the provinces of Designer resource.

The course documents for the three Institutions in question would seem at least to cover the same areas: Technology, History of Art & Design, Management, Business Studies, Humanities, Liaison with Industry..... What is perhaps at issue is the light in which these topics are dealt with and imparted. What is relevant is the priority and the model acquired by the Student reacting to the Lecturer.

#### 10.7 Historical Perspective

At this stage it is useful to refer back to some of the ideas put forward in Chapter 3.

In 3.10 it was proposed that Design thought evolved according to a kind of dialectical process. A distinction was made between Classic and Renascent modes of thought in Design.

Classicism was made up of established ideas and forms, now conventionalised and accepted, but originally responses and solutions to needs. Original solutions to design problems, where function and form evolved in some kind of dynamic equilibrium, became not means to an end, but ends in themselves.

Renascence was the breaking of the mould or paradigm in the way suggested of scientific paradigms by Kuhn (1962) - usually in response to situations of flux or crisis in which there was a general abandoning of conventional thought or values.



This situation obtained in Great Britain after the period of the French Revolution when the Continent was recovering and for the first time beginning to compete seriously with us in industrial production.

It obtained after the 1939-45 war when there was a similar period of flux. The criteria and examination systems of Design education underwent a process of refurbishing, but at the time competition from the Europeans and the Japanese was virtually non-existent. This may well have contributed to a "Classic" situation wherein Design courses acquired conventions and a type of aesthetic dogmatism. This in turn encouraged an introversion on the part of students and lecturers and a lack of communication with industry. In return industry regarded, perhaps still regards, Industrial Design as a kind of luxury, a back-room activity, peripheral to the main purposes and policy of the company.

Now that we are obviously facing competition and problems, awareness is spreading of the crisis but real knowledge is still thin. Classicism seems to be going by the board and we are due to another period of Renaissance, wherein the whole system may be re-examined in an insightful manner.

There is an evident need for the Design syllabus to pay more ostensible attention to what may be called the bread and butter side of commercial life. This study has shown that Manufacturers perceive shortcomings in such areas as general business procedures, standards of written presentation, discipline at work in such matters as deadlines and time keeping.

At the same time Students put more store on what they regard as the creative side of Design - what has been encapsulated here as Higher Abilities. Manufacturers pay lip service to this side in the IDEAL model but seem to perceive it as peripheral to the main thrust of profitability.

What would seem to be required is education for both sides:

This could take the form of a sustained campaign of information whereby Manufacturers would be apprised at a local level of exactly what is aimed at in the Design courses.

An organized and sustained series of Poly experience for the Manufacturer to parallel the present system of work experience for the Student.

In addition it is suggested that part of the course for the Industrial Designer could be aimed at improving inter and intra-personal perception. Much in practical Design depends on teamwork, and much depends on appreciating other peoples' perspectives. The content in this might centre on such skills as Transactional Analysis or similar interpersonal psychologies (Spitz 1945, Levine 1960, Berne 1966). Other skills involving group interaction analysis could also prove useful ( Bales 1951, 1970).

There are some caveats that must be entered. Information per se does not always enlighten. Divided opinions may sometimes be entrenched even further unless information is perceived to be both accurate and non-tendentious. It is in this light that interpersonal skills on the part of Designers is seen to be important. Stamper (1973) gives an interesting overview to research into the result of presenting evidence to groups.

It is obviously impractical to talk of educating the Manufacturer in these skills, but it may well be that as a result the aspirations of the Student postulated above to be the pivot in the team may be brought more into line with the aspiration of others, notably the Manufacturer. Understanding is the key.



## 10.8 Summary

The results of the Loglinear analysis provide a complex though comprehensible picture. In addition to providing an intellectual image whereby to visualize the models pertaining to various groups, it provides an insight into the internal structure of these models, thus highlighting the similarities and the differences between them.

Perhaps the most salient points to emerge from the analysis are the following:

1. In Higher Order Abilities, Attitudes at Work, and Values both REAL and IDEAL, Manufacturers present a different model from that of Students, Lecturers and Designers.

In Visual, Verbal, and Knowhow IDEAL Manufacturers are again different from Students, Lecturers and Designers, whereas in REAL, Students are the odd ones out.

2. In Visual, Verbal, and Knowhow REAL, London differs from the other two Institutions and converges to that of Manufacturers.

3. It is noted that Design courses are effective in that they perform what Lecturers would regard as their function. Students acquire the same conceptual framework as their Lecturers, but this is not necessarily to say that a wider and more realistic framework should not be exposed to the Students and form extra input to the courses.

4. The conceptual models for the "Upper" class of Degree and the "Lower" do not coincide. In some respects there are more affinities between "Lower" and Manufacturer.

## CHAPTER 11

### MEASURES OF VALUES, PATTERN RECOGNITION, & PERSONALITY

#### 11.1 Introduction

The Survey of Industrial Design by its nature was used to reflect the User Conceptual Model of Design practitioners, its domains, its contours, its differences or its similarities in various groups.

A larger view, and one which could set the Industrial Design student in an academic and an occupational context, could be achieved by using measures of value judgement, intelligence and personality traits. These could be compared with norms derived from groups other than Industrial Design.

These measures were:

1. The Survey of Values (SSV)
2. The Pattern Recognition Test (PRT)
3. The Eysenck Personality Questionnaire (ESP)

The SSV was administered to five groups of students (Brannigan 1985) from the following disciplines:

Industrial Design, Social Work, Fine Arts, Business Studies, Maths.

The PRT scores from Industrial Design students were compared with published percentiles on the Raven's Progressive Matrices and also with the equivalent deviation IQ's as given by Terman-Merrill (Terman 1960) and Otis (Lennon & Otis 1950) tests.

The EPQ scores were compared with published norms for a range of ages and occupational groups. T tests were used to reveal any significant differences between Industrial Design groups and others.



## 11.2 The Solomons' Survey of Values (SSV)

The Survey of Values (Solomons 1970) is an instrument whereby the relative importance attributed to six value domains is quantified:

Theoretic, Pragmatic, Aesthetic, Social, Dominant, Metaphysic

It is therefore possible to subject them to statistical analysis.

They represent six different personal viewpoints, or global attitudes, or predispositions to perceive the world.

The dominant interest of the Theoretic person is the discovery of truth and this is synonymous with the process of analysis and comparison. As far as possible all judgements concerning the beauty and utility of things are eliminated.

The Pragmatic person is concerned with utility. Knowledge by itself is not of value; it acquires values by dint of being used and being useful. Frequently this basic attitude is transformed into a preoccupation with economic, financial and business matters.

For the Social person, people are valuable in their own right and all other things - money, beauty, truth are subordinate to this. People are to be treated as ends in themselves and not as means to ends.

The Aesthetic person appreciates pattern, harmony, form. He or she need not necessarily be creative, but is sensitive and enjoys events as they happen for their own sake.

Power is the value for the Dominant person and struggle and competition are vital. This person excels in situations where he can attain and control people.

For the Metaphysic person there is a sense of the interrelatedness of things and subjective and objective link into one whole. There is a global synthesis of all the faculties, escalating sometimes to a

certain mysticism. Rational, pragmatic, aesthetic, moral, ethical value all combine.

In the Survey of Values these Values are presented two at a time in a forced choice situation and the consequent number of permutations is 15. There are three replications along these lines and thus a total of 45 items. To each item is allocated a total of three points and therefore there is a grand total of 3 x 45 points to be distributed among the six Values. This in turn implies that the scores obtained are inter-related inasmuch that a very high score, say on Aesthetic, would deplete the remaining points available for the other Values. This experimental design follows that used for the Study of Values (Allport 1960) and the British revision of the Study of Values (Richardson 1965). A fuller description of the Survey of Values is to be found at Appendix V.

### 11.3 Student groups

The SSV was used to compare five independent groups of undergraduates and graduates from Leicester University and the Polytechnics of Leicester, Teesside and the Central School of Art and Design, London

These groups were as follows:

1. Industrial Design - All Polytechnics
2. Social Workers - Leics Univ
3. Fine Arts- Leics Poly
4. Business Studies - Leics Poly
5. Maths - Leics Univ



SURVEY OF VALUES (SSV)

VALUE PROFILE A

ALL STUDENT GROUPS

Theoretic Pragmatic Aesthetic Social Dominant Metaphysic

30

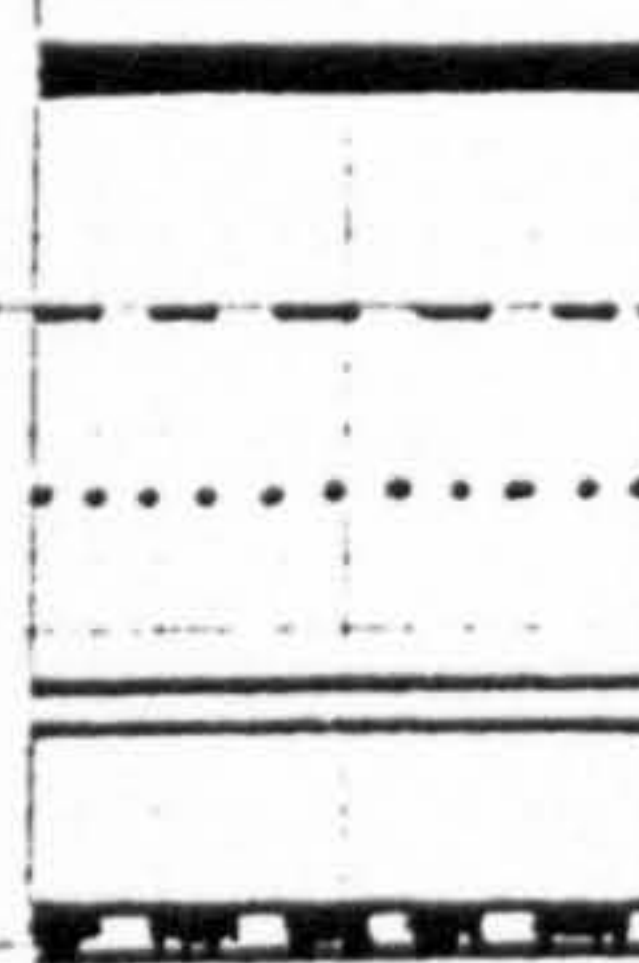
25

20

15

MEAN  
SCORES

1. INDUSTRIAL DESIGN
2. SOCIAL WORK
3. FINE ARTS
4. BUSINESS STUDIES
5. MATHEMATICS





#### 11.4 Value Profiles

Differences between groups may be displayed graphically in terms of Value Profiles (Diagrams 30 to 36) in which the raw scores from the Survey of Values (SSV) are plotted.

The statistics on which these Value Profiles are based follow:

Table 18    Summary Table of Means - Values (SSV)

| GROUP       | THEORETIC | PRAGMATIC | AESTHETIC | SOCIAL | DOMINANT | N   |
|-------------|-----------|-----------|-----------|--------|----------|-----|
| Ind.Des.    | 19.125    | 22.00     | 23.539    | 27.633 | 20.125   | 138 |
| Social Work | 16.731    | 19.192    | 22.981    | 29.981 | 20.154   | 52  |
| Fine Arts   | 18.612    | 16.122    | 30.429    | 31.400 | 14.653   | 49  |
| Bus.Studies | 20.698    | 27.491    | 19.943    | 23.377 | 21.604   | 53  |
| Maths       | 24.633    | 22.061    | 17.449    | 27.388 | 19.388   | 49  |

Profile A (Diagram 30) contains all the Student groups, that is:

1. Industrial Design
2. Social Workers
3. Fine Arts
4. Business Studies
5. Maths

It shows how close to the overall means lie the Industrial Design means. It also shows the raw spread of scores and how, for example the AESTHETIC score for Group 3 is much above the others. The least discriminating value is METAPHYSIC.



PROFILES B To F (Diagrams 31 to 35) present single graphs of the Student Groups in order and include for comparative purposes plots of the overall means. They should be read in conjunction with the preceding analysis.

Profiles G is for purposes of comparison. It was obtained from the complete Sixth Form populations of Wolverhampton and formed part of a study of Value judgemental similarities and differences between Arts and Science and between Male and Female populations.(Solomons 1970)

Both Value Profiles and the table of means needed a more rigorous analysis and the accompanying significant differences needed to be borne in mind, since the absolute differences between means is at times minimal. An account of this more extended analysis follows and details of the techniques used are to be found in Appendix VI.

#### 11.5 Techniques used

The scores derived from the individual values of the SSV cannot be assumed to be normally distributed, but the total number of cases under investigation was of such an order that the central limit theorem could be invoked. The use of Analysis of Variance was therefore justifiable.

A One way Analysis of Variance was carried out with all five groups taking Theoretic, Pragmatic, Aesthetic, Social, Dominant scores from the possible six Values of the SSV as independent variables.

This ANOVA proved significant ( $p < 0.000$ ) for every Value and so did a nonparametric Kruskal-Wallis ANOVA which was also performed.

Subsequent trend analysis, using Newman-Keuls procedures localised the major sources of variance within each value as described in 11.5.1.

Details of this procedure, together with ordered means and the "tailored" q statistic of the Studentised Range derived from the Table of Means (Table 18) are to be found at Appendix VI.



DIAGRAM 31

SURVEY OF VALUES (SSV)

VALUE PROFILE B

INDUSTRIAL DESIGN STUDENTS

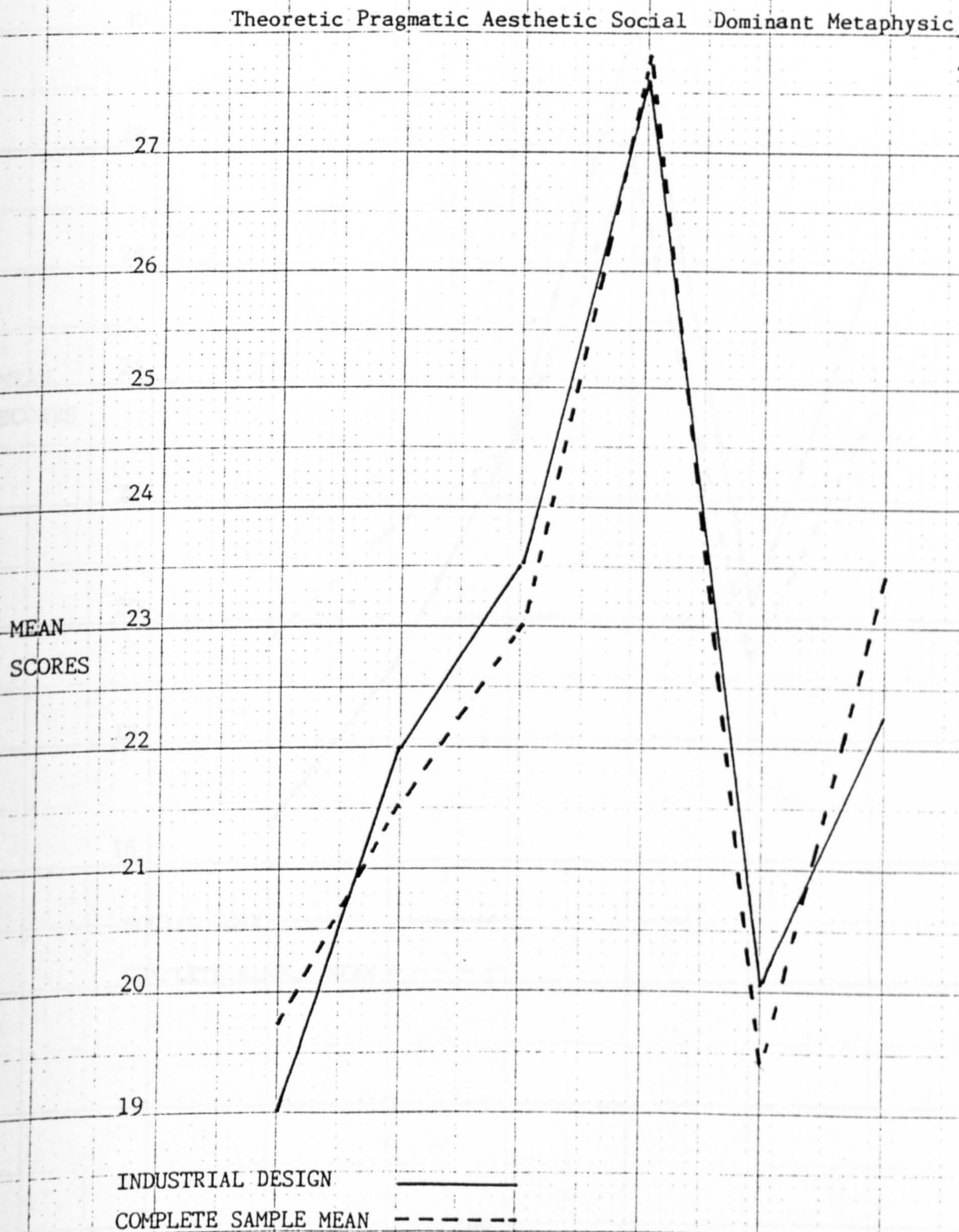




DIAGRAM 32

SURVEY OF VALUES (SSV)

VALUE PROFILE C

SOCIAL WORK STUDENTS

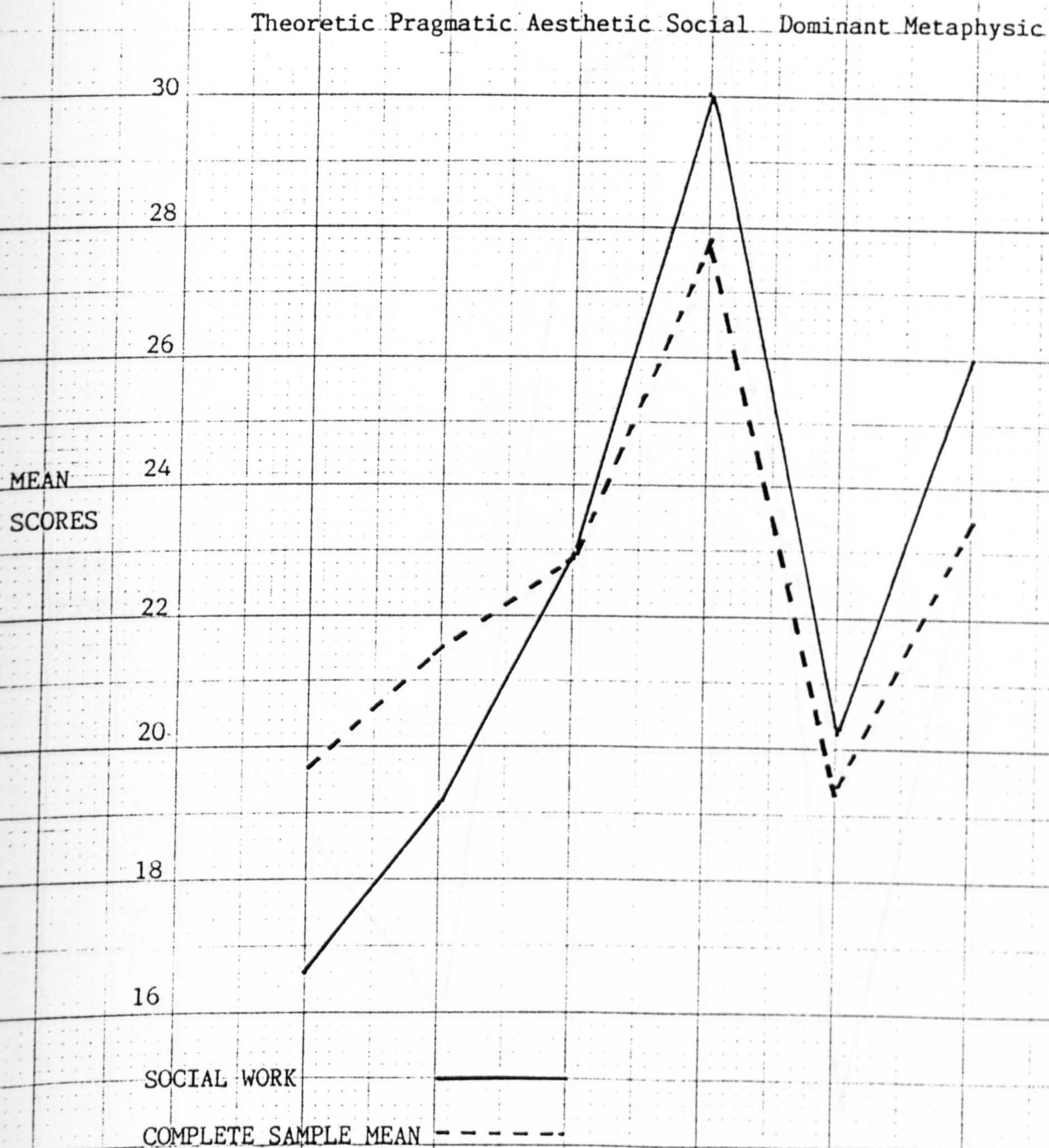




DIAGRAM 33

SURVEY OF VALUES (SSV)

VALUE PROFILE D

FINE ARTS STUDENTS

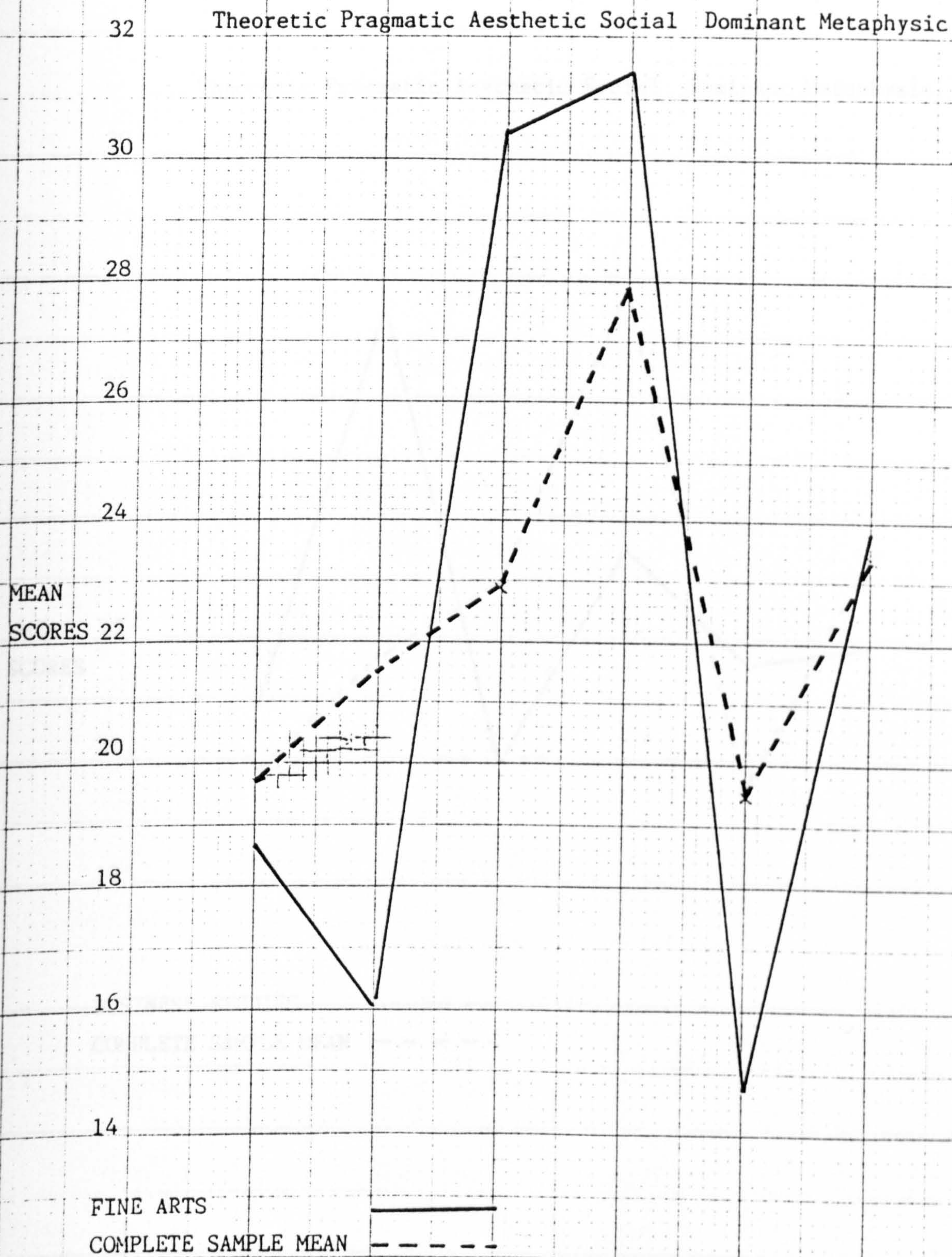




DIAGRAM 34

SURVEY OF VALUES (SSV)

VALUE PROFILE E

BUSINESS STUDIES STUDENTS

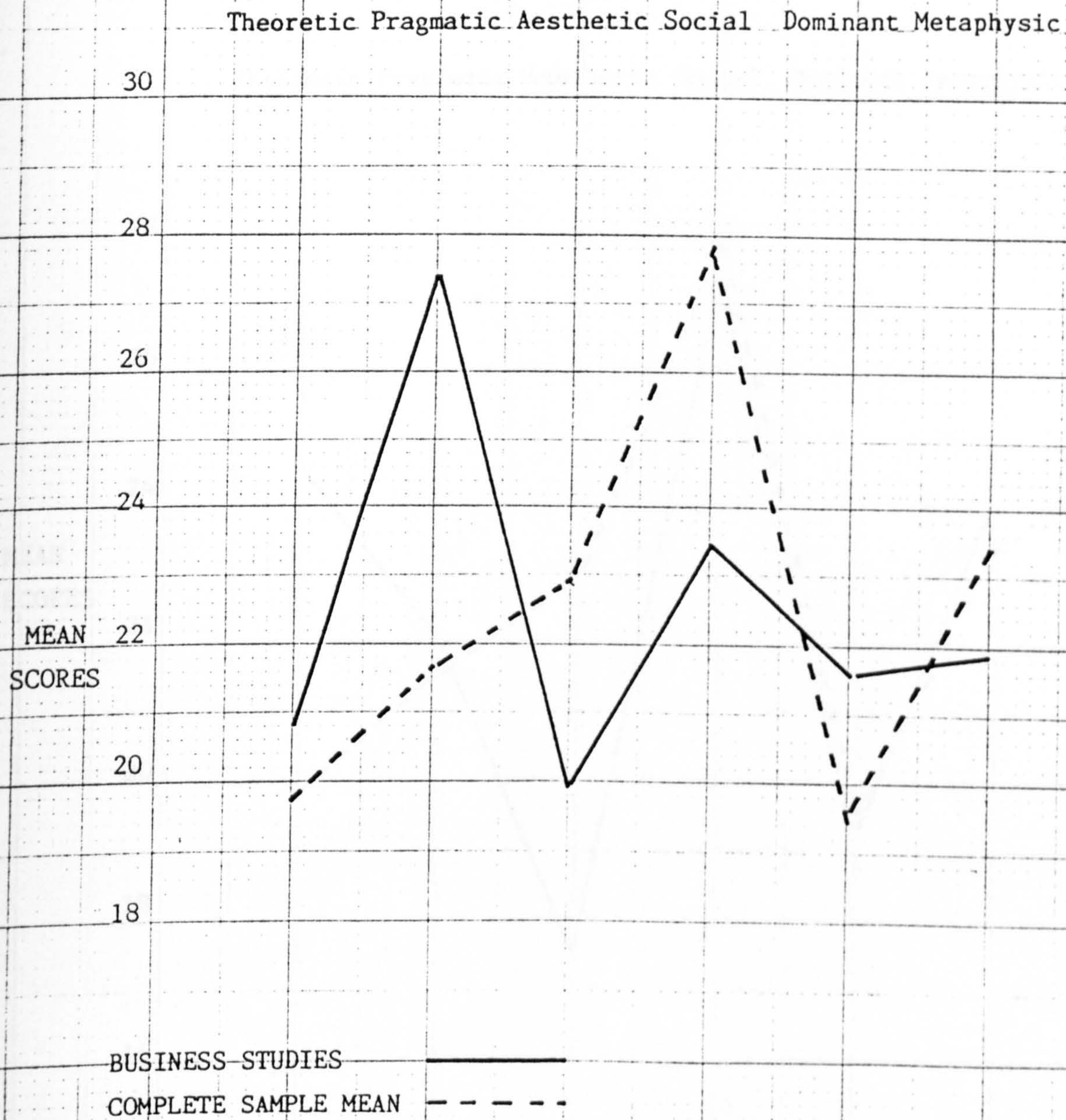


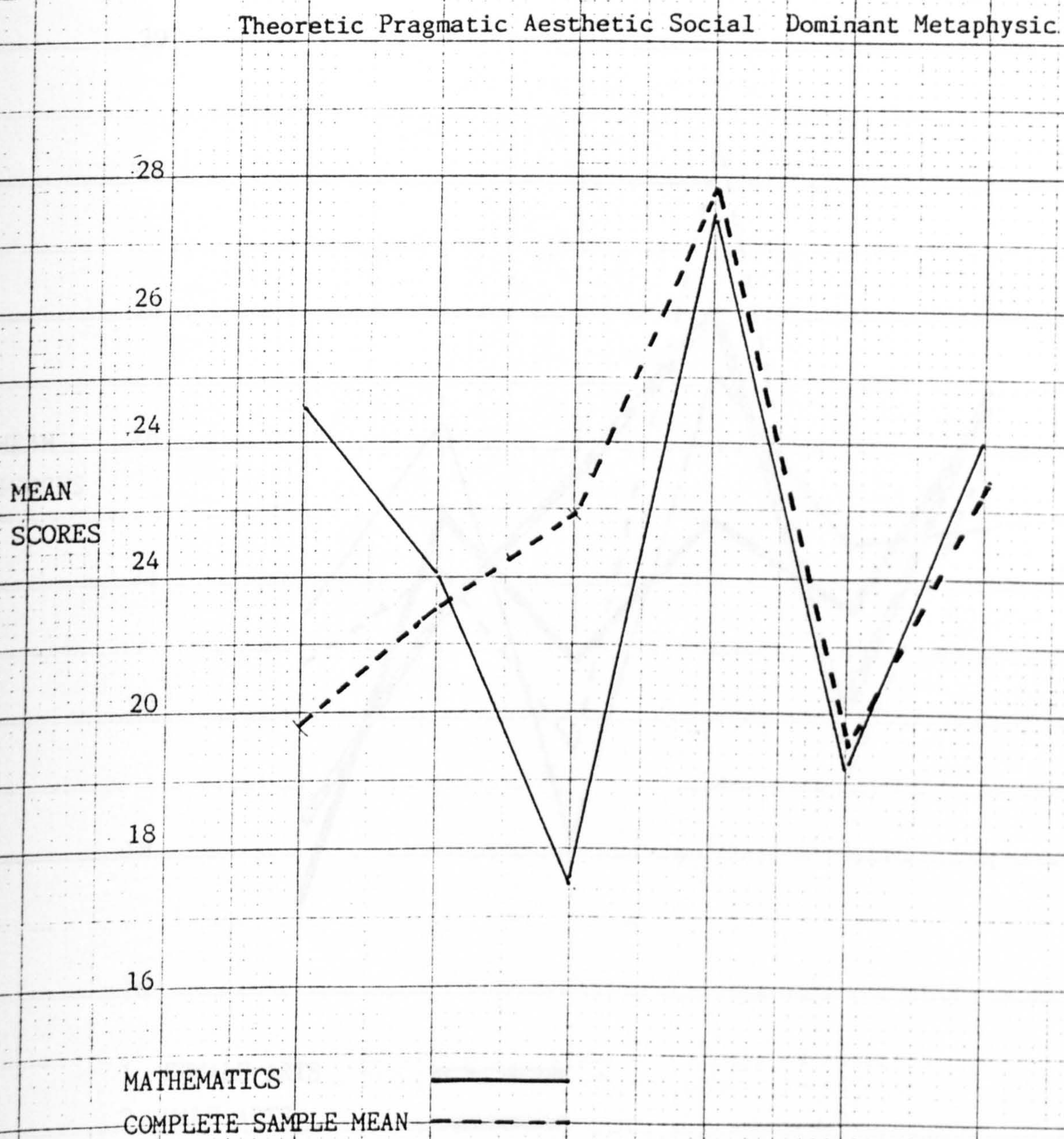


DIAGRAM 35

SURVEY OF VALUES (SSV)

VALUE PROFILE F

MATHS STUDENTS

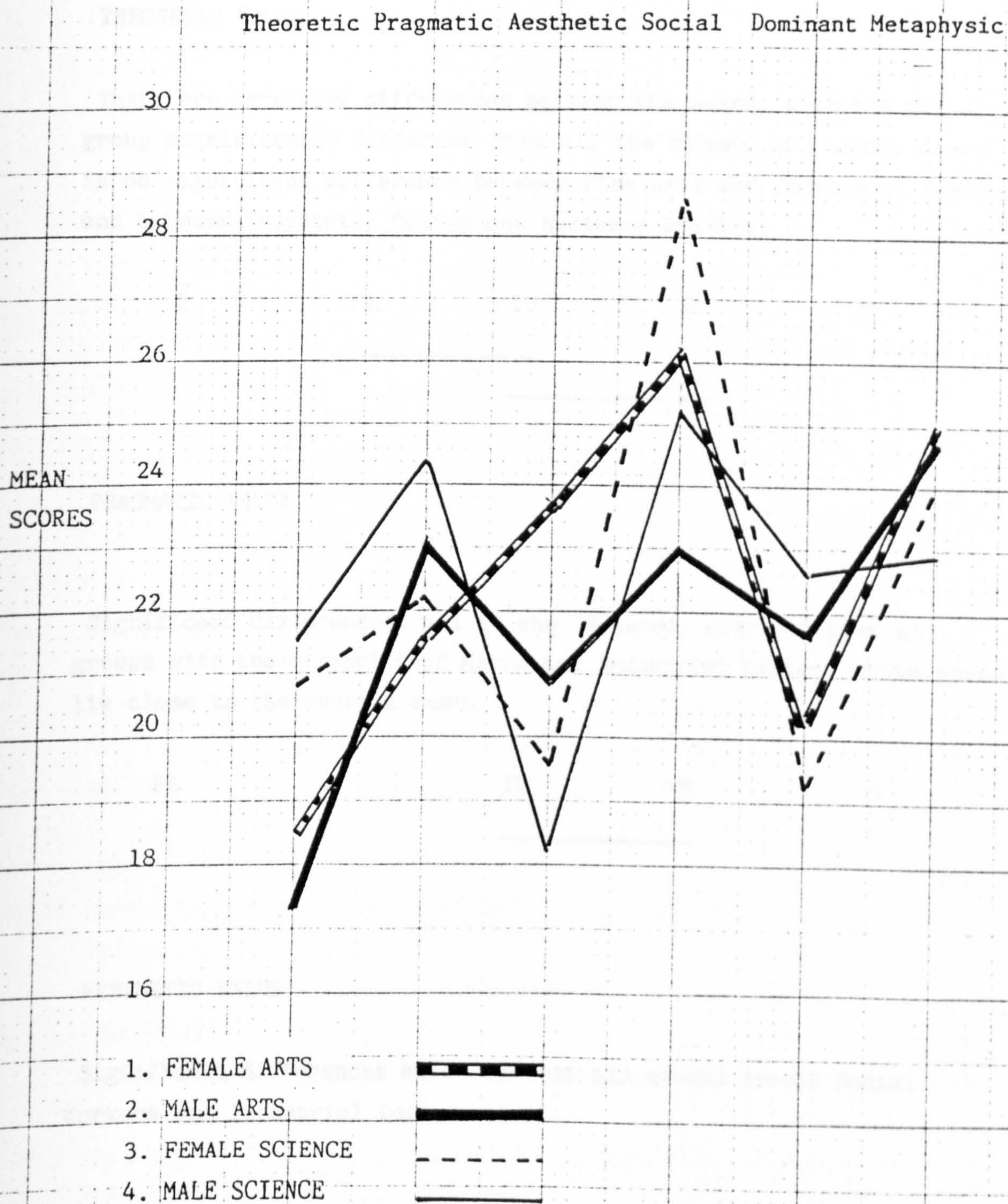




SURVEY OF VALUES (SSV)

VALUE PROFILE G

ARTS AND SCIENCE STUDENTS





### 11.5.1 Summary Differences between Group means according to Value

The finding that there are no significant differences between certain groups is indicated by an underlining.

#### THEORETIC VALUE

There are extensive differences between the means, with the Maths group significantly different from all the others ( $p < .01\%$ ). There is no significant difference between Fine Arts and Industrial Design, and between Industrial Design and Business Studies

|   |       |       |   |   |
|---|-------|-------|---|---|
| S | FA    | ID    | B | M |
|   | <hr/> |       |   |   |
|   |       | <hr/> |   |   |

#### PRAGMATIC VALUE

Significant differences, all at the 1% level, exist between all groups with the exception of Maths and Industrial Design, whose means lie close to the overall mean.

|    |   |       |   |   |
|----|---|-------|---|---|
| FA | S | ID    | M | B |
|    |   | <hr/> |   |   |

#### AESTHETIC VALUE

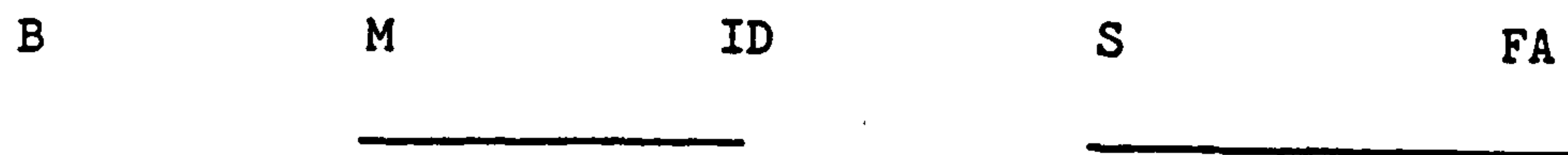
Significant differences exist between all groups except Social Workers and Industrial Design.

|   |   |       |    |    |
|---|---|-------|----|----|
| M | B | S     | ID | FA |
|   |   | <hr/> |    |    |



## SOCIAL VALUE

Business Studies is significantly lower than all the other groups. Maths and Industrial Design together form a subset which in turn is significantly lower than the top subset of Social Workers and Fine Arts.



## DOMINANT VALUE

Fine Arts is significantly lower at the 1% level than all other groups



## Discussion

The results produced by the respective groups are quite distinctive. Here follows a summary of the order of importance attached to each value:

### THEORETIC:

Maths. Business Studies. Industrial Design. Fine Arts. Social Work.

### PRAGMATIC:

Business Studies. Maths & Industrial Design. Social Work. Fine Arts.

### AESTHETIC:

Fine Arts. Industrial Design. Social Work. Business Studies. Maths.

### SOCIAL:

Fine Arts. Social Work. Industrial Design. Maths. Business Studies.

### DOMINANT:

Business Studies. Industrial Design & Social Work. Maths. Fine Arts.

There are, however, some unexpected orders.

The Fine Arts group are significantly elevated on AESTHETIC, as could have been expected, but they are also so on SOCIAL, even above the results for Social Workers.

The Industrial Design group is second to Fine Arts in AESTHETIC , but this is not to say a great deal, since it is a very poor second. The aesthetic component is greatly tempered by the need to look for practicality.

In all, the Industrial Design group present a profile very much an average of the five groups, and this provides some intellectual backing to the statement often forthcoming in interview from Design practitioners that they thought of themselves, or at the least aspired to be the Renaissance people of the 20th Century.

#### 11.6 The Pattern Recognition Test (PRT)

The Pattern Recognition Test was chosen as being particularly apt to this study, embodying as it does a measure of nonverbal intelligence which correlates reasonably with other IQ measures such as Terman-Merrill and Otis-Lennon. Published percentile scores for Raven's Progressive Matrices and for the verbal intelligence tests permit direct comparisons to be made with other groups. These percentiles are to be found at Table 19.

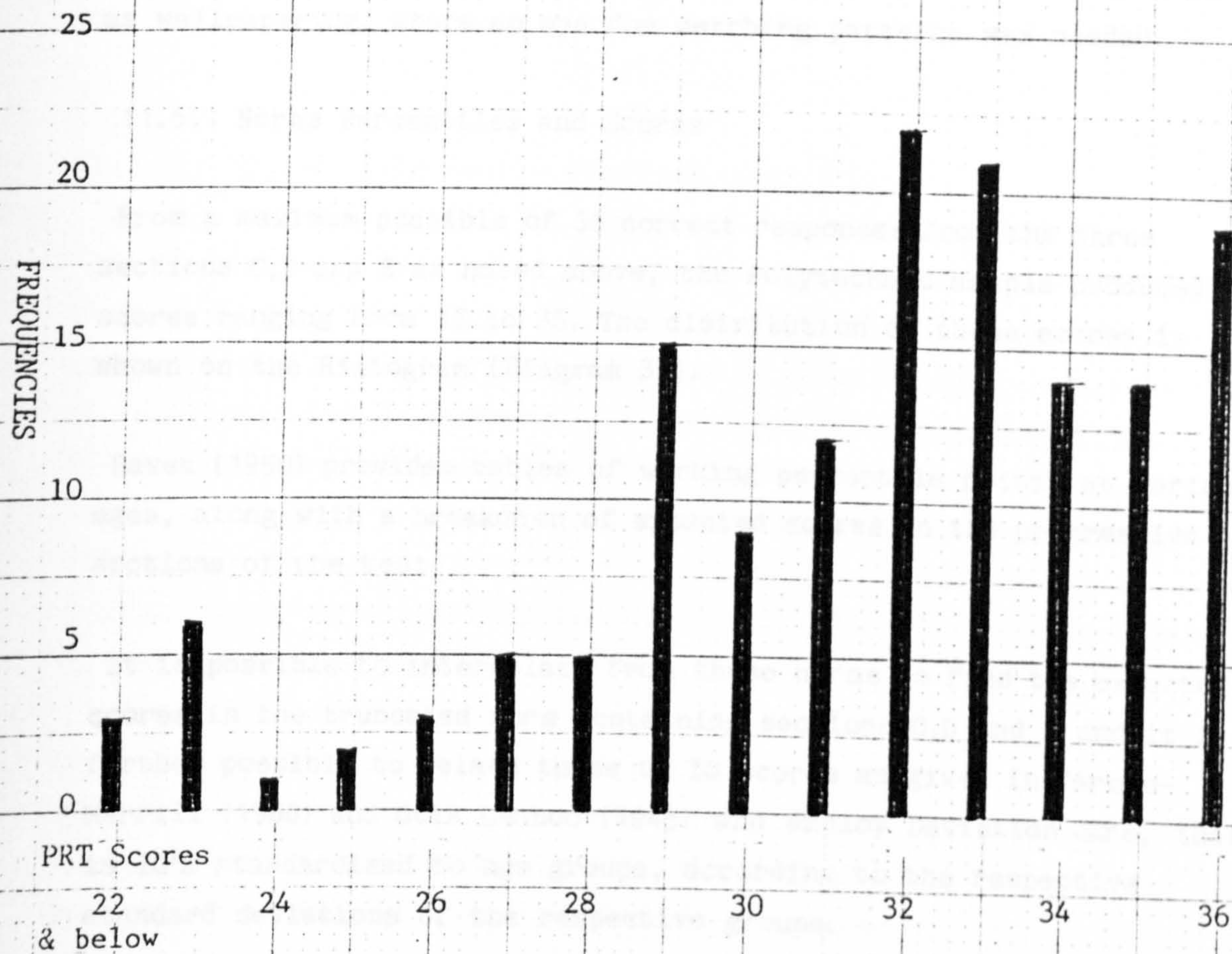
It also contains an element of visual and spatial recognition that should presumably form part of an Industrial Designer's talents.

The PRT is the "harder" portion of the Raven's Progressive Matrices, that is the last three of sections A,B,C,D and E. All of the sections follow the same format in that they consist each of 12 problems demanding a choice of the appropriate pattern block to fit into a matrix. They are progressive in the sense that the problems become more difficult as the subject proceeds. The choice of the correct pattern is presumed to be made on intellectual grounds following the deduction of the rules governing each matrix.



DIAGRAM 37

Histogram to show frequency of scores on  
PATTERN RECOGNITION TEST.  
by Industrial Design Students



Equivalent I.Q.'s

100

111

126



It may also be surmised that some choice may be made on other than intellectual, even intuitive grounds, paying regard to the balance and symmetry of the completed matrix. There are accounts, possibly apocryphal, of individuals scoring relatively poorly on standard verbal IQ tests, such as the Terman- Merrill, and yet obtaining maximum scores on the Progressive Matrices. The accounts would have us believe that these individuals were employed in such occupations as wallpapering, where an eye for matching patterns was needed.

#### 11.6.1 Norms Percentiles and Scores

From a maximum possible of 36 correct responses from the three sections C,D and E as noted above, the Polytechnic sample produced scores ranging from 17 to 36. The distribution of these scores is shown on the Histogram (Diagram 37).

Raven (1950) provides tables of working percentile points at various ages, along with a breakdown of expected scores in the progressive sections of the test.

It is possible to interpolate from these norms to find the expected scores in the truncated form containing sections C,D and E and it is further possible to relate these to IQ scores as given in Terman-Merrill (1960) and Otis Lennon (1945) who employ Deviation IQ's, that is IQ's standardised to age groups, according to the respective standard deviations of the respective groups.

Table 19 Equivalent PRT scores and IQ scores

| PRT Score | Section Scores | Percentile | Deviation IQ |
|-----------|----------------|------------|--------------|
| 31        | 11 11 9        | 95         | 126          |
| 30        | 11 11 8        | 90         | 118          |
| 26        | 10 10 6        | 75         | 111          |
| 22        | 9 9 4          | 50         | 100          |
| 17        | 8 7 2          | 25         | 85           |



### 11.6.2 Discussion of Pattern Recognition results

If we consider the performance of the Industrial Design Polytechnic population, we note a range from 17 to 36, that is from 25th to the 100th percentile. The mean is 31.4 and the standard deviation 3.7. The distribution is skewed towards the top end and the great majority of the individuals come within the top 5% of the population. This is to be expected with undergraduates and graduates.

### 11.7 The Eysenck Personality Questionnaire (EPQ)

The EPQ has been used in a wide variety of situations and is therefore well suited for comparison purposes in the present study. Eysenck postulates that personality may be parsimoniously described in terms of scores along certain dimensions. These dimensions are derived by Factor Analysis from scores on many different samples of behaviour so that common elements are revealed. Results produced by different researchers differ in some respects according to the methods of Factor Analysis used, but it is possible to find agreement on two major dimensions.

One of these dimensions is called by Eysenck "Neuroticism" and people scoring low on this are characterised by stability, purposiveness, confidence, lack of anxiety. Conversely those scoring high tend to be anxious, undependable, neurotic, lacking persistence.

The second is called "Extraversion-Introversion". The familiar extravert-introvert dichotomy has been used in psychology since its original formulation by Jung (1928) and has also entered common parlance. Eysenck's Extravert dimension is orthogonal, that is independent from Neuroticism and a high score indicates a social, cooperative-liking person.

Later Eysenck (1952) suggested that these two factors were not adequate to describe personality. He quotes experiments to show that at least two dimensions are required to discriminate between psychotics and neurotics and therefore states that a third dimension

of Psychoticism, again orthogonal to both the other two, is necessary. In its extreme form psychoticism ranges from schizophrenia to dementia.

There are indications that psychoticism is related to creativity, which in turn could result from conflict and complexity within the person. McKinnon (1961) finds distinct elements of psychopath in various categories of creative person:

1. The Artistic - an expression of inner states and conflicts typified by the Fine Arts person.
2. The Scientific - operating creatively on some aspects of the external world.
3. The Hybrid - the person who tries to express himself and manipulate things according to the demands and problems put forward. This could typically be the Industrial Designer.

It is also in line with the findings of Barron (1963) that creative persons are more complex psychodynamically and prefer complexity and assymetry.

Here follow details of norms for a whole range of ages and occupational groups taken from Eysenck (1975), together with those from the present study.



Table 20 Comparative norms for Age Groups - EPQ

| AGE GROUPS |      |              |        |              |        |             |        |
|------------|------|--------------|--------|--------------|--------|-------------|--------|
| Males      |      | Psychoticism |        | Extraversion |        | Neuroticism |        |
| Ages       | N    | M            | St.Dev | M            | St.Dev | M           | St.Dev |
| 16-19      | 540  | 4.63         | 3.27   | 14.46        | 4.27   | 10.69       | 5.08   |
| 20-29      | 768  | 4.19         | 3.26   | 13.72        | 4.79   | 9.81        | 5.09   |
| 30-39      | 404  | 3.27         | 2.75   | 12.85        | 4.73   | 9.33        | 5.18   |
| 40-49      | 327  | 3.09         | 2.59   | 12.38        | 5.14   | 9.17        | 5.06   |
| 50-59      | 208  | 2.57         | 2.51   | 10.76        | 5.29   | 10.12       | 5.40   |
| 60-69      | 65   | 2.56         | 2.47   | 10.44        | 4.97   | 8.51        | 5.60   |
| All        | 2312 | 3.78         | 3.09   | 13.19        | 4.91   | 9.83        | 5.18   |
| Student LD | 138  | 4.26         | 2.99   | 13.12        | 4.53   | 11.58       | 4.82   |
| Poly       | 155  | 4.41         | 2.91   | 13.14        | 4.52   | 11.93       | 4.76   |

Norms for occupational reference groups particularly applicable to the Industrial Designer are listed in Table 21.

Table 21 Comparative norms for occupational groups EPQ

| OCCUPATIONS |     |      |        |       |        |       |        |
|-------------|-----|------|--------|-------|--------|-------|--------|
|             | P   |      |        | E     |        | N     |        |
|             | N   | M    | St.Dev | M     | St.Dev | M     | St.Dev |
| Actors      | 29  | 4.43 | 3.14   | 13.21 | 5.23   | 11.28 | 5.85   |
| Architects  | 15  | 4.60 | 2.32   | 11.07 | 5.26   | 10.03 | 6.36   |
| Engineers   | 144 | 3.19 | 3.05   | 12.86 | 5.22   | 9.37  | 5.27   |
| Lecturers   | 19  | 4.40 | 3.01   | 11.76 | 5.56   | 9.97  | 4.64   |
| Teachers    | 35  | 3.17 | 3.62   | 11.03 | 6.02   | 9.10  | 4.83   |

Table 22 Comparative norms for students EPQ

STUDENTS

|           | P   |      |        | E     |        | N     |        |
|-----------|-----|------|--------|-------|--------|-------|--------|
|           | N   | M    | St.Dev | M     | St.Dev | M     | St.Dev |
| Artists   | 27  | 7.76 | 4.06   | 12.26 | 5.34   | 12.69 | 3.88   |
| Engineers | 18  | 4.17 | 2.43   | 13.78 | 4.58   | 10.72 | 4.91   |
| Designers | 138 | 4.26 | 2.99   | 13.12 | 4.53   | 11.58 | 4.82   |
| Poly      | 155 | 4.41 | 2.91   | 13.14 | 4.52   | 11.93 | 4.76   |

11.7.1 Discussion of differences revealed in EPQ results

T tests revealed the following differences:

- a. Comparison between Industrial Design students and the general population between the ages of 20 and 29 showed the former as more anxious. This difference was highly significant at the 0.1% level.

Peer Age group (20-29) and Industrial Design Students

Difference at  $p \leq .001$  \*\*\* level in Neuroticism  
( $t=6.85468$ )

- b. Comparison between Industrial students and students in general similarly revealed a difference in anxiety level with the former as less anxious. This difference was quite significant at the 1% level.

Students in general and Industrial Design Students

Difference at  $p \leq .01$  \*\* level in Neuroticism  
( $t=3.0608$ )

- c. Comparison between Industrial Design students and Fine Arts students using scores along the Eysenck Psychotic dimension showed a highly significant difference at the 0.1% level with Fine Arts scoring higher in Psychoticism.

Art Students and Industrial Students

Difference at  $p \leq .001$  \*\*\* level in Psychoticism.  
( $t=9.6938$ )



d. Comparison between Industrial Design and the rest of the general population shows the former scoring higher both in anxiety and psychoticism. This difference is significant at the 0.1% level.

General population and Industrial Design Students

Difference at  $p \leq .001$  \*\*\* level in Neuroticism ( $t=6.8539$ )

Difference at  $p \leq .001$  \*\*\* level in Psychoticism ( $t=3.0634$ )

It is evident that so far as personality dimensions are concerned that Industrial Design and Fine Arts are significantly different both from their peer age groups and also from the general population. These differences centre on Neuroticism and Psychoticism dimensions, both of which are salient in Industrial Design and Fine Art student make-up. Industrial Design is however less psychotic and this may be attributable to the intrinsic need of the Designer to be pragmatic in his approach to his design concepts and to keep in closer touch with reality. Creativity may be associated with Psychoticism and this relationship could be explored further.

### 11.8 Summary

The behavioural measures which, together with the Survey of Design, made up the complete battery in the study were used to set the Industrial Design student in his academic and societal context.

The Solomons' Survey of Design (SSV) was used with five groups of students from Industrial Design, Social Work, Fine Arts, Business Studies, and Mathematics. Significant differences were found between all student groups on all Values, but in general terms Industrial Design occupied a central position.

In the Pattern Recognition Test the great majority of Industrial Design students returned scores within the top 5% of the general population. This is a result which may be expected in an undergraduate sample.

The Eysenck Personality Questionnaire revealed significant differences in two of Eysenck's personality dimensions:

- a. Industrial Design students show themselves as more anxious than most people of their age group.
- b. Industrial Design students are less anxious than students in general.
- c. Fine Art students score higher on Psychoticism than do Industrial Design students
- d. Industrial Design students score higher both in Neuroticism and Psychoticism than does the general public.

In sum, therefore, it would seem that the Industrial Design student, when compared with his fellow students, is not extreme in his value judgements.

His performance on the non-verbal intelligence test is at least on a par with other students, although there are indications emerging from the Loglinear analysis of Class of Degree that performance on verbal intelligence may not be so good.

There is, however, some common ground with Fine Arts students in Eysenck's Neuroticism and Psychoticism dimensions. In both of these dimensions Industrial Design and Fine Arts score higher than students in general, their general peers and the general population. A plausible interpretation is that both these dimensions play their part in the aesthetic and creative activity of Industrial Design.



GENERAL CONCLUSIONS

12.1 Introduction

The study began as an examination of the activity of Industrial Design as conceived by those involved in it, whether as Students, Lecturers, Designers or Manufacturers.

Little research had been directed to this end although the Hayes Report (1983) had drawn attention from the Manufacturers' point of view to mismatches between the views of Manufacturers and Designers in the United Kingdom, France and Germany.

The fact that the Hayes Report was commissioned by the Design Council and the D.E.S. is an indication of official unease about the Design situation. It was evident that the priorities and the concepts held by Design practitioners did not always coincide. Moreover it was by no means clear in what respects they differed. The present study addressed this problem by seeking to articulate such similarities and differences, and to develop a methodological approach for studying qualitatively such similarities and mismatches.

To undertake the study a number of questions were posed:

How can one articulate and reveal what are essentially private rules of action and sets of guiding concepts, so that others may see in what respects their concepts differ?

Since the activity of Industrial Design is by its very nature so complex, varied and individually creative, how is one to construct relatively parsimonious models and compare one group of design practitioners with another.

In this respect the study shared problems similar to many in the Social Sciences. There is an infinite variety in human activity and this is compounded by an infinite variety in the way which humans perceive and conceive of their and others' activity.

## 12.2 Approaches

Four approaches were made to the above problems:

a. An historical account of Design. Its purpose was to add an historical dimension to the concepts of Industrial Design, commenting on the changes in Establishment viewpoints as revealed in public documents and polemic.

b. A theoretical account of perception, categorization and concept formation, together with definitions of terms as used in the study. This formed the essential underpinning of the experimental investigation.

c. An experimental design whose main object was to bring into the public domain the private conceptual world of Design practitioners, to analyse this in such a way as to make apparent underlying patterns and thus to compare these patterns.

d. A general comparison with other groups in society and in Education, using tests of personality, intelligence and value judgement. In this way the Industrial Design student might be viewed in perspective.

## 12.3 Research and Methodological Implications

This study marks a significant departure from traditional methodological approaches towards Design. Its main feature is the combination of two statistical techniques:

Multidimensional Scalogram Analysis and Loglinear Analysis.

The first is used to determine the optimal ways in which data derived from interviews coheres - that is the categories into which it may be divided. It is important to note that these categories are not imposed on the data - they arise from it. In an important sense therefore, they avoid the accusation of being a priori categories. Multidimensional Scalogram Analysis is also used to determine how subgroups of people differ in their attitudes towards different aspects of the Design situation. This general approach delineates the conceptual models held typically by practitioners of Design and in particular by subgroups within Design:



Students, Lecturers, Practising Designers, and Manufacturers

The second technique explores in more detail the structure of the models held by these subgroups, so that similarities and differences may be mapped. It should be noted that it is used here as an investigative tool. Loglinear analysis has been used to date as a predictive tool, for example in medical research where the parameters of a situation are well established and what is sought is a model which will predict a favourable outcome to certain treatment or drugs.

In its function as an investigative tool specific questions are not asked about certain a priori variables, but it is used to probe the content of the model, its internal structure and relations between the components of the model. In this usage the associations and the terms of the model assume an importance in themselves.

This is new in that patterns in the development of conceptual models may be explored, for example as students proceed through the course, or as they emerge from training and enter the world of Design proper. It serves also to highlight differing conceptual priorities and may thus emphasize the actual or potential mismatches in attitude or understanding.

The combination, then of the two techniques is unusual. There is in the world of Design a large volume of literature, but this is almost entirely of a theoretical and speculative nature, rather than based on a body of quantifiable and verifiable information. The present study seeks to approach Design in a scientific way.

This scientific approach is based on the Cognitive Psychology of such as Rosch and Rey and their taxonomy has provided a theoretical base to the empirical study. Research methods and their parallel theory are discussed in 4.18 and the relationship between theory and the study is set forth for the Pilot Survey at 5.1 and for the Survey of Design at 6.1.

Concepts and Conceptual Models in this research may be thought as cognate with the basic and superordinate categories of Rosch. The items of the Surveys presenting individual Design events and objects may equally be considered equivalent to her subordinate category. In the same way the categories postulated by Rey of simple and complex classification may be taken to correspond with concept and conceptual model.

The system of categorisation proposed by Rosch in particular is particularly apposite and seminal insofar as the study is concerned and her ideas served as theoretical guidelines to the empirical approach.

The 25 items in the Survey of Design relate specifically to the theoretical framework in that they represent categories at the Roschian basic level. The items, then, are at the basic level. They are already removed and abstracted from actual objects, processes, events, behaviour encountered by the Designer in the course of his Design activity. These latter would be thought of as the subordinate level of the Roschian taxonomy.

The domains arrived at following Smallest Space Analysis SSA1 are a further abstraction and occupy the apex of a hierarchy of categorisation. The domains - Higher Order Abilities, Visual Presentation Skills, Verbal Presentation Skills, Knowledge and Knowhow, Attitudes at Work, and Values and Orientations are illustrated and informed by the prototypic items at the basic level. They are at the superordinate level according to Rosch.

One of the major areas of investigation in the study was to determine how the domains were related in various groups. This pattern of domains and the bonds which associated some and not other groups of Design protagonists was the subject of Loglinear analysis. It is this last level which is the Conceptual Model in the study.

Thus in an actual Design Situation, the Designer may be involved in watching a computer screen and engaged in Computer Assisted Design. This behaviour is unique in some respects because each actual problem is new. It also has many things in common and is understood in terms of a basic level of categorisation exemplified in Item 15 of the Survey of Design: "The Industrial Designer has/should have an understanding of relevant computer techniques".

Item 15 forms part of the domain "Knowledge and Knowhow", associated in varying fashion by different groups to other domains, as shown in the Loglinear models and Schematic Diagrams of Chapters 9 and 10.



## 12.4 Main Findings

The main points to emerge from the investigation are as follows:

a. Industrial Design, viewed from an historical standpoint is seen to parallel social and economic climates, alternating between what is termed in Chapter 3 "Classic" and "Renascent" paradigms. The United Kingdom at present is characterized by a Renascent climate of opinion wherein previously accepted and conventionalised values are being questioned. It is surmised that Industrial Design needs to evolve in responses to new needs and new technology, and this is recognized in official circles - hence the current interest in design matters.

b. It follows in such a period of reorganization and questioning that mismatches occur. Not all those concerned in Design are cognate in their perceptions or their concepts. Using the techniques mentioned in 12.3 it is possible to distinguish common conceptual domains and thus achieve a set of common denominators of comparison.

These conceptual domains are identified using Multidimensional Scalogram Analysis of the Pilot Survey and the Main Survey of Design data as:

Abstract or Higher Order Skills  
Presentational Skills - Verbal and Visual  
Knowledge and Knowhow  
Attitudes at Work  
Values and Orientations

c. Differences in response emerge between two broad populations:

Educational  
and  
Commercial

These differences, from the Manufacturers' viewpoint, are focused on what they see as an actual lack of priority on the part of Designers in the following areas:

Written literacy (as opposed to verbal fluency)  
Financial insight  
Marketing skills  
Business knowhow

The above are perceived deficiencies in actual performance.  
From an IDEAL point of view, Manufacturers would like to see:

Greater skills in dealing with clients and understanding briefs

More practicality in design concepts

More collaboration with other experts in industry

More knowledge of market trends

More knowledge of engineering and production techniques

More attention to detail

Better keeping to deadlines

More knowledge of financial implications

It may be that the division between the Educational and Commercial populations is susceptible to further interpretation. The priorities quoted above are pragmatic and short term. They are doubtless connected with the need on the part of industry to gain quick profit, improve the cash flow, step up productivity, increase efficiency.

A long term view is difficult to maintain if one cannot plan beyond the potential span of current government policy, nor if one is looking over one's shoulder for the Receiver. A long term grasp of fundamentals, exemplified by the Higher Order Abilities and the Values of this study, may prove more efficient than short term expediency.

A useful distinction is between Education and Training. By training is meant the acquisition of skills specific to a task. This of course is economic and adequate, provided the task remains roughly the same. But this is the short term view in a world which is changing and accelerating in change. What is required is Education, that is the acquisition of superordinate skills which will enable the Designer to respond to changing situations. The danger is that short term Training and courses geared strictly to narrow skills may have in the end a disastrous effect on longterm and over-reaching skills. There is the opposite danger that Education geared to a highly theoretical and abstract courses may not produce the goods and may alienate Industry.

In fact both Training and Education are necessary and what is required is an informed and acceptable balance.



d. Loglinear analysis established further detail about the links between these domains and how the patterns and strengths of association varied.

Status subgroups for example shows Manufacturers with a different model from all others in Higher Order Abilities, Attitudes and Values, both IDEAL and REAL and in Visual, Verbal and Knowhow IDEAL.

Only in Visual Verbal and Knowhow REAL do Lecturers and Designers converge to Manufacturers, leaving Students separate. Even in this it is noted that London Students converge to the Manufacturers' model.

Differences emerge between "Upper" class graduates ( First and Upper 2nd degrees) and "Lower" (Lower 2nd, 3rd, Referred, Fail). "Lower" show affinities with Manufacturer. "Upper" model stresses the Verbal skills and the Higher Abilities.

The Central School of Art and Design, London reveals a different model from that of Leicester and Teesside Polytechnics.

e. Comparisons with external groups, employing measures of Value judgement, Non-verbal intelligence and Personality reveal the following:

Industrial Design students occupy a central position in Value scores with regard to student peers in other disciplines.

Industrial Design Students in Non-verbal intelligence scores are comparable with student peers.

Industrial Design and Fine Art students are significantly different in Neuroticism and Psychoticism from student peers, from their peer age-group (20-29), and from the rest of the general population.

Implications of these general findings are now discussed.

## 12.5 Implications in Education

From the experimental portion of the study it is possible to draw more detailed inferences.

There would seem to be differences in conceptual models between the Institutions - Leicester, Teesside and London. These differences cannot be attributed directly to differences in formal Design training, since the syllabi are very similar. There may be oblique differences in training relating to different presentation and methodology and different staff background. One may point also to the availability and accessibility in London of varied and realistic sources of experience. London provides rich and relevant background material, together with a ready access to a wide range of Design expertise.

It is obviously not feasible to transfer these facilities, to export to the provinces this wealth of stimulus material to be found in and around London. It may be suggested however that efforts be made to redress the balance. Like most policies this would require money and resources. Official, that is Government sponsored, policy could dispatch more systematically travelling exhibitions to the Institutions outside London. Policy could also facilitate more and longer access, on the part of Design students and as an integral part of their course, to what goes on in London. This would form part of course enrichment, and as such should qualify for mandatory grant.

One of the indirect effects on Design education in London stems from the fact that there is a large and realistically orientated supply of Designers who may be called on to act as part-time Lecturers. This contributes in large measure to the differences found between Institutions.



While it is recognized that provincial Institutions employ locally based Designers and also enlist the aid of other visiting lecturers, it would seem that this practice is limited. An important part of the Design course should be to communicate reality as well as to provide for growth beyond. People who know what this reality is from experience and stark necessity are needed to impart this knowledge.

Institutions know this to be true, but for various reasons, some of inertia, both intellectual and emotional, some of sheer lack of resources, it is not done to the extent required. A large input to Design courses should come from part-time Designer/Lecturers (rather than Lecturer/Designers), from eminent consultant Designers, and from Manufacturers. Clearly this recommendation has cost implications.

The following implications relating to courses and curriculum also follow:

a. Design Courses

It does not seem that performance in Design courses can realistically be predicted using simply the Survey of Design. At least part of the reason lies in the lack of common experience and knowhow on the part of debutant students.

It might however prove feasible to use the Survey of Design to monitor conceptual models during the course.

There is also evidence that predictive value may be found in the use of the EPQ and the SSV allied to the norms to be found in the study. Performance on both these measures has been established at an early age and are reasonable bases for prediction.

When monitoring entrance standards there is some reason to dwell on language proficiency. This is a focus of disquiet so far as Industry is concerned and is also a criterion for Class of Degree.

## b. Curriculum

On this last point it would seem that the curriculum might put more weight on language in the shape of formal written presentation and also on oral presentation. Given that syllabi and official pronouncements include such elements, the actual priorities accorded in Design courses do not appear to be high, and this is reflected in the conceptual models of students. Industry complains of deficiency in this field and efforts could be made to remedy this.

There would also seem to be a place in the curriculum for more training in what could be regarded as plain business ethos and practice. This figures in official syllabi, and for example the latest Design Council travelling exhibition "Young Creators 1987". So far as industry is concerned, it must be seen to be done.

In more general terms, a certain training in what may be called person management may be advisable. Insight into oneself and into the behaviour of others is essential - especially when the Industrial Designer aspires to become the nexus of the Design process. As a Designer, as with many other professions which work in teams, it helps to appraise others and to adjust one's perspectives accordingly.

Allied to this and in line with ideas put forward by CNA (1987), there may be great value in offering at least some of the course material of the Design for Management courses current project schemes at Leeds, Leicester, Kingston, Bristol, Middlesex Polys and the Humberside College of Higher Education to students of Design. At the same time students of management could follow some of the Design syllabus.

"Managers ought to know the facts of the present situation. There is therefore a need for empirical research to identify the present pattern of design management and identify the factors which influence it. Without a sound and substantial empirical basis, the teaching of management cannot be convincing."

CNA (1987)



## 12.6 Implications in Industry

There seems to be a gap between the conceptual model of the Manufacturer and that of the others. To some extent this gap is obscured by the propaganda of Design which may present an idealised picture of Design Education. The Manufacturer does not seem to relish what he regards as unwanted and overweening aspirations on the part of Industrial Design. He perhaps does not see these as relevant and contributory to profit - his ultimate aim. One of the tasks of Design Education may be to convince Industry of their viability, whilst moderating excessive and unrealistic attitudes on the part of Students.

The Manufacturer takes for granted the actual expertise of the Designer and the practicalities of Design. What strike him as lacking are written skills and down to earth commercial knowledge and disciplines. The Designer may well regard them as peripheral skills - and he would maintain that he already possesses them. Nevertheless this appears to be the perception of Industry.

Valid information at a local level involving relations with Industry and a positive programme of information dissemination, combined with two way links between Industry and Institution would seem advisable to eliminate the myths and the mismatches. A Public Relations programme is suggested.

## 12.7 Comparisons with external groups

By definition the Survey of Design was inapplicable to groups studying other disciplines and other occupational groups. It was, however, possible to use other measures to compare Industrial Design students with their peers and other professions and occupations.

In this study, either directly or using published norms, a value judgement survey, a non-verbal test of intelligence and a personality questionnaire were used to provide a societal perspective on the Industrial Design student.

The Solomons' Survey of Values was used directly with other students groups: Social Work, Fine Arts, Business Studies and Mathematics. These groups, together with Industrial Design differed significantly on all values, but in general terms Industrial Design occupied the middle ground. It would seem, therefore, that the repeated aspirations of the Designer to control and co-ordinate the Design process receives some support.

The nonverbal test of intelligence - in fact the harder sections of Raven's Progressive Matrices demonstrated that the results for Industrial Design students were within the limits expected in an undergraduate population.

The Eysenck Personality Questionnaire showed some significant differences on two of the dimensions: Neuroticism and Psychoticism. Design students were more anxious than their peers at the 0.1% level and less than students in general at the 1% level. They were scored less on Psychoticism at the 0.1% level than Fine Arts students. A combination of Neuroticism and Psychoticism showed Industrial Design scoring higher than the general population. These results show the Industrial Design student as occupying the middle ground in terms of sensitivity between the Fine Artist and the rest of the population.

## 12.8 Further applications

The methodology used may be applied in the study of similarities and mismatches in conceptual model in various other social and occupational groups.

As an extension of this particular study, however, it could perhaps be advantageous to employ some of these techniques with further samples taken from those involved with Design:

The present study concerned itself with three Institutions:

Leicester Polytechnic

Teesside Polytechnic

The Central School of Art and Design, London.



Even from this sample differences were obvious in the case of London. The extension of research to the many other colleges in London and in other parts of the United Kingdom could well provide findings of interest to all concerned with Design, whether in Government circles, in Industry or in Design training.

There has been some overlap in the categories, notably between Lecturers and Designers. These categories could be refined in a much larger study, since the numbers involved would permit viable sample numbers. In this way exhaustive categories ranging from full-time Lecturers of Design with no business interests, through Lecturers with minimal outside business interests, to Designers with minimal lecturing commitments could be defined.

Full time Designers could similarly be differentiated, notably between Staff or Inhouse Designers attached to large companies and freelance or Consultant Designers. Any such differences are collapsed in the present study since the numbers involved do not allow such distinctions.

Similarly Manufacturers have been treated as if they were all in comparable situations. This is manifestly not the case and a larger study could deal with separate types of manufacture: heavy, light, consumer durables, electronic and so forth.

### 12.9 Some final thoughts

The methods of analysis used in the study, while they have been used in other investigations, have proved to be in combination adequate to appraise the human data without distorting it and without imposing strict a priori categories.

It would seem that a reasonable and economic way of categorizing Design activity could be in terms of the five domains discussed:

Higher Order Abilities

Attitudes at Work

Values and Orientations

Presentational Skills

Knowledge & Knowhow

They provide a useful way of comparing types of Design practitioners and also progress in concepts during a Design course.

There are evident mismatches between what may be termed Education and Industry and these mismatches have been to some degree articulated. The fact that what may have been felt to be obvious to the Manufacturer or to the Designer or to the Lecturer as a source of disagreement has been put onto a research basis may lead to public debate and conciliation.

On this last point Stamper (1973) has some interesting comments. He notes that divided opinion will not necessarily be brought into closer accord merely by supplying the best available evidence. The crucial element in conciliation would seem to be the perception of either side of the accuracy and lack of bias of the evidence. If there is a lack of confidence, opinion becomes even more polarized.

To these comments it may be added that in the present study all efforts were made to avoid bias and a priori conceptions. Moreover there is a common interest on the part of Design Education, Industry and Government to improve Design and provide an added impetus to agreement.

This study has explored relatively unknown terrain and mapped in tentative fashion some of its contours. It has however revealed some other paths which may be worthwhile to follow. More research may well produce fruitful suggestions as to any change in Design syllabi. What seems clear at this stage is that it would be desirable to lead both Design Education and the Manufacturer to a common frame of reference.



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## APPENDICES

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APPENDIX I

INTERVIEW MATERIAL

## Interview material

Preliminary interviews were carried out with Students of Industrial Design, Lecturers of Industrial Design and Consultant Designers in an endeavour to map out the conceptual areas that entered into Design.

Here follow a selection of extracts from interviews arranged in categories and with the source noted:

### AESTHETIC/CREATIVE/FLOW OF IDEAS

Aesthetics is not so important as creativity (Student 1st Year).

Imaginative flair and creativity (Lecturer).

Combines technology with sensitivity (Lecturer).

Not necessarily aesthetics (Lecturer).

An applied artist (Consultant Designer).

I work from the nice looking (Student 3rd Year).

Ability to analyse a problem (Student 1st Year).

He has to analyse the criteria (Lecturer).

He must define the problem (Lecturer).

The Industrial Designer is more creative than stylistic (Student 2nd Year).

Aesthetics is increasingly unimportant (Lecturer).

The Industrial Designer has to be a source of innovation (Student 3rd Year).

There is essentially aesthetic appeal (Student 2nd Year).

Ability to produce a series of ideas and sketches (Student 3rd Year)

The Industrial Designer must know what is good (Student 2nd Year).

It has to look right (Student 2nd Year).

The Industrial Designer must think big and then relate it to technology (Student 1st Year).

I do not relate Fine Arts to Ind Design (Consultant Designer).

The Industrial Designer is a fertile but not necessarily prettified source of ideas (Lecturer).

The Industrial Designer is a combination of artist and engineer (Consultant Designer).

The consumer is swayed by aesthetics (Consultant Designer).

The Industrial Designer has broad new ideas (Lecturer).



The Industrial Designer must choose products that look nice (Consultant Designer).

The Industrial Designer has the ability to pursue an idea (Lecturer).

The Consultant Designer has wider insights as a result of varied experience (Consultant Designer).

I am against pretty drawing (Lecturer).

Design is an approach driven by aesthetics (Lecturer).

The Industrial Designer has an enquiring mind (Lecturer).

Designers are problem solvers (Student 3rd Year).

The Industrial Designer is after a Fine Arts shape with good engineering (Student 3rd Year).

We need to look for creativity, imagination and motivation (Lecturer).

#### PROCESSES/MANUFACTURING/TECHNICAL KNOWHOW

The Industrial Designer understands industrial process (Lecturer).  
Material science is important to the Industrial Designer (Student 2nd Year)

The Industrial Designer is a mixture of technician and artist (Consultant Designer).

The manufacturer can fill in the technology (Lecturer).

The Industrial Designer must understand the technology (Consultant Designer).

The Industrial Designer must leave it to the Design Engineer and others (Consultant Designer).

He has to know about how the product is manufactured (Consultant Designer).

He should know a bit about everything (Student 2nd Year)

As soon as you know too much you lose your flair (Student 2nd Year)

Technology comes first (Student 3rd Year)

The Industrial Designer is someone who is interested in how things work (Consultant Designer).

He should know enough to ask the right questions (Lecturer)

He must be able to modify things so that they become practical (Lecturer).

Production is the concern of the engineer (Lecturer).

There is an affinity between function and styling (Lecturer).

Function always comes first (Lecturer).

#### COMMERCIAL AND INTERPERSONAL SKILLS

The Industrial Designer must have the ability to draw and present his ideas (Student 1st Year)

The Industrial Designer is relatively poor at writing (Lecturer).

He must play a part on the Board, one amongst equals (Lecturer).

The Industrial Designer possesses political acumen (Lecturer).

He must have enough knowledge to relate to others (Student 2nd Year)

The Industrial Designer must be able to put ideas across (Student 1st Year)

He must be able to make decisions (Student 2nd Year)

The course needs more Business Studies (Student 2nd Year)

Business Studies takes up time that should be devoted to Design (Student 3rd Year)

Industrial Design values are more commercial than social (Lecturer).

The main factor is communication (Student 3rd Year)

There is an emphasis on presentation (Student 3rd Year)

The Industrial Designer is able to synthesize from the different ideas that specialists have (Lecturer).

The Industrial Designer is able to organize extreme views (Consultant Designer).

Costing is difficult for the Industrial Designer (Consult. Designer)

He is just another specialist, like a Manager or an Accountant (Consultant Designer).

The Industrial Designer has a multidimensional model for reconciling many factors (Lecturer).

He is someone to actuate a team (Lecturer).

The Industrial Designer goes to others for input (Lecturer)

Lots of students have a reluctance to get involved with commercial ideas (Lecturer).

The severest restraint is designing down to a price (Lecturer).

Large agencies usually employ specialists to do all communication (Lecturer).

The Industrial Designer is not commercially orientated (Consultant Designer).

The whole business is communication (Lecturer).

Commercial restraints do not inhibit creativity (Lecturer)



The whole business is communication (Lecturer)

Commercial restraints do not inhibit creativity (Lecturer)

### MARKETING AND THE CONSUMER

The Industrial Designer must design in the context of the time (Lecturer).

He is a socially responsible person (Student 2nd Year)

There is a lot of marketing in the make up of the Industrial Designer (Student 3rd Year)

The Industrial Designer would like to see a better world (Student 3rd Year)

He is entrepreneurial and at the same time aesthetic (Lecturer).

He must understand the consumer end (Lecturer).

### PERSONALITY AND INSIGHT

The Industrial Designer has a practical intelligence (Lecturer).

He has a deep intelligence and an ability to link disparate ideas (Lecturer).

The Industrial Designer has a clear perception of himself and of others (Lecturer)..

There is a distinction between understanding about things and about how to do things (Lecturer).

His value system is not hierarchic - there are no priorities because they all hang together (Lecturer).

Above all he is adaptable (Consultant Designer).

The Industrial Designer is self-actuating (Student 2nd Year)

You must sell yourself (Student 2nd Year)

He is willing to take risks (Student 1st Year)

Students feel on a higher plane - they will learn (Consultant Designer).

If you are mean and selfish your Design will be mean and selfish (Student 3rd Year)

There must be mental agility and a breadth of knowledge (Lecturer).

## CHANGES IN PERCEPTION OF THE INDUSTRIAL DESIGNER

There was no difference over the course but subsequently a great deal (Consultant Designer).

There is a lot more to it than I thought (Student 1st Year)

My ideas have become more refined (Student 2nd Year)

My ideas have totally changed (Student 2nd Year)

You may have to unlearn things you have learnt on the course (Student 3rd Year)

You don't know anything till you get out (Student 1st Year)



APPENDIX II

MATERIAL FROM REPORTS AND INSTITUTIONS

## Material from Reports and Submissions from Institutions

To add to the material derived from Interviews certain Reports commissioned by the DES, the Design Council, the CNAA and Polytechnics were examined. This represents what might be called the "Establishment Model" and was also borne in mind when the Pilot Survey was constructed.

Here follow various precis from these Reports:

### National Advisory Council on Art Education - 1st Report 1960

Notes that students of Product Design "may need to acquire a substantial knowledge of engineering".

It also recommends that the History of Art should be studied throughout the course and should be examined. About 15% should be devoted to the "History of Art and complementary studies".

### NACAE 3rd Report 1964

Notes that students of Art and Design are exceptional only in that "scholarship in the generally accepted sense may not be relevant to their work".

### NACAE Structure of Art and Design Education 1970

Comes down in favour of sandwich courses insofar as 3D Design, that is including within the course a period of industrial or professional experience. Concludes that the majority of students completing such courses will be ready to proceed directly to employment.

The study of Fine Arts is regarded (euphemistically) as "not necessarily central to all studies in the Design field"

There is however a note of dissent by Nikolaus Pevsner about the History of Art: "I don't want to reserve more, but I regard the 15% (see above) as a dire necessity, provided they are looked at as



intellectual discipline. It is clarity of thought and expression.....it is ultimately understanding they must achieve. But to understand one must know the facts; to know the facts one must learn the facts, and to choose relevant facts one must command a surplus of facts".

In the above Reports there seems an element of déjà vu. The general thinking is parallel to that which had obtained for Secondary Education and embodied in the Spens Report.

The general tenor seems to be that a difference must be struck between University and Polytechnic education:

Universities are concerned with the preservation, extension and dissemination of knowledge for its own sake.

Polytechnics have a tradition which is adaptable, inclusive, innovative, vocational. They are concerned with professional and vocational training rather than with knowledge for its own sake.

#### CNAA Report on BA Hons courses in Art and Design 1975-6

Notes that Industrial Design is concerned with :..."materials.. physical properties.....study of form.....utility and costing.....the problem solving activity generally".

There is some concern that techniques are stressed at the expense of aesthetic standards and admits that the regulations governing the History of Art are being increasingly questioned by some staff teaching "main studies" and states that it is "contentious".

#### DES Report on the Employment of Art College Leavers 1972

This gives some insight into the views of Employers. It gives a shopping list of those qualities looked for employers. The effect is overwhelming and the following list may say more about Employers rather than Designers:

Creativity, imagination, originality  
Ability, talent, expertise, practical ability  
Practical application in a commercial situation  
Drawing ability, basic design skills  
Professionalism, high standard of work  
Ability to communicate visually or verbally Knowledge of costs,  
economical approach  
Willingness to learn  
Sense of responsibility, self confidence  
Ability to work hard under pressure  
Ability to work as part of a team  
Personality, character, appearance, manners  
Versatility, flexibility Intelligence, initiative, common sense

It is also interesting to note the priority accorded to some of these qualities:

35% put creativity as top  
29% put practical application as second  
25% put professionalism as third  
15% put intelligence as last.

Manchester Polytechnic Inst of Advanced Studies 1974

This Report by Nick Wayte and David Cooper analyses certain aspects of Art and Design curricula.

The recommendations and objectives suggested therein are interesting in that the ideal conceptual model may be inferred from them.

The objectives are defined in behavioural terms, but it must also be accepted that "behavioural" is extended from its usual connotations to include...." insight and understanding and other inferentially established qualities of mind, for example attitudes, values and beliefs".



1. Basic education emphasizing the application of design to industry.
2. Methods and media in the presentation of design
3. A defensible concept of the role of design in society
4. Ability for constructive self appraisal and self adjustment in developing situations
5. Ability to work as a member of a team
6. Ability to conceive projects in 3D terms as well as graphically
7. Experience in the investigative and inventive aspects of design

Design Council The Design Requirements of Industry 1983

The Hayes Report was commissioned by the DES and the Design Council and carried out by Chris Hayes and Keller Horsey Associates.

The Report enquires into the skills, knowledge and attitudes which industry (British and European) requires from the Industrial Designer and uses a research methodology which involved rating 71 items on a scale of 0 to 5 in three contexts:

Ideal Today, Real Today, 15 Years On

These 71 items were identified under the following heads:

Design Functions or Tasks, Design Competencies.

Priority was given to visualizing the product concept, representing alternative design solutions, seeing the product in its market context. Creativity was seen to be the most important of skills. Some dissatisfaction was expressed with lack of professionalism (a disciplined approach), working to deadlines, ability to communicate orally and in writing with the rest of the company. In particular industry was concerned with lack of skill in assessing the financial implications of the design. It was felt that the balance was wrong between costing and aesthetics. The Industrial Designer opted for aesthetics and it was thought by industry that Design education should prepare better for the realities of the market.

## Application for approval of Degree of M.A. Design

This application to CNAA for a degree approval submitted by Leicester Polytechnic reveals what may be termed the overt ostensible and establishment conceptual model of Industrial Design.

From the section on Aims and Objectives:

"Responsibility to society. Scholarly attitude to Learning. Creative problem solving activity. Systematic development of ideas through to production. Communicate information....by graphical, verbal. written and modelling means. Works successfully with others. Has knowledge of.. ...the aesthetic and cultural base.....the legal and financial framework.....the developmental, manufacturing and marketing processes.....social needs and behaviour.

"The following attributes.....are considered essential in a post graduate student.....self motivation.....ability to focus on detail and relate this to broader issues....wide interests.....technical knowledge.....aesthetic sensitivity.

" The student should consider marketing strategy....product range.....competitive products already on the market...production strengths (and weaknesses).....costs, sales volume.....product life.....legislation.

" Design practice.....should encourage original, sensitive and effective solutions to design.....provide students with greater understanding of the environment that applies the pressures (and opportunities) to the Industrial Designer."



APPENDIX III

THE PILOT SURVEY

## Pilot Survey on Industrial Design

### INTRODUCTION

This survey is designed to investigate how people involved in Industrial Design, either in Education or in Industry, understand it. The results may well highlight any mismatches in understanding and could prove informative and useful to all concerned.

### BACKGROUND INFORMATION

1. Please state your age ..... years
2. Sex (please tick the appropriate box) M ☐ F ☐
3. Status (Please tick the appropriate box)

|               |                          |
|---------------|--------------------------|
| Student       | <input type="checkbox"/> |
| Lecturer      | <input type="checkbox"/> |
| Examiner      | <input type="checkbox"/> |
| Consultant    | <input type="checkbox"/> |
| Designer      | <input type="checkbox"/> |
| Staff         | <input type="checkbox"/> |
| Designer      | <input type="checkbox"/> |
| Director      | <input type="checkbox"/> |
| Ind.Executive | <input type="checkbox"/> |
4. Please give formal title of your present position  
.....
5. If a student give the name of your present Polytechnic or other Institution and the stage you have reached in Industrial Design education.  
.....
6. If not a student give the number of years you have held this or similar post.  
..... years



QUESTIONNAIRE

Preliminary interviews with those associated with Industrial Design have produced a number of statements with which you may agree ( or disagree) to some extent. After each statement you will find two sets of six boxes. The set on the left is for you to express your opinion in the ideal situation - how you would like things to be. The set on the right is for you to express your opinion in the real situation - how you have actually experienced it. The extremes are labelled Agree..... Disagree. There are six shades of opinion for you to choose and these will correspond to:

|                  |               |                |                   |                  |                     |
|------------------|---------------|----------------|-------------------|------------------|---------------------|
| Definitely Agree | Largely Agree | Slightly Agree | Slightly Disagree | Largely Disagree | Definitely Disagree |
|------------------|---------------|----------------|-------------------|------------------|---------------------|

PLEASE TICK ONE BOX ONLY IN EACH SET

7. "The flow of ideas is the single most important quality"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
8. ".....essentially an entrepreneur"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
9. "... has detailed insight into the relevant manufacturing methods"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
10. "... a person of considerable commercial acumen and drive"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
11. ".... is not too aware of production constraints, and in fact these might inhibit a fresh approach"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
12. ".... above all the product has to look right"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |

13. "... is able to transform a client's brief into a set of visual ideas"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
14. "...is basically there to present the product artistically"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
15. "...has experience in production and is competent to suggest relevant techniques"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
16. "...is never in a rut - thinks laterally and prolifically"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
17. "... thinks in human terms and is concerned for the user"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
18. "... attuned to the consumer and knows how the product will slot into the market"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
19. "... the money motif is the main one behind all design decisions"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
20. "... starts by putting the problem before all people involved simultaneously"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |
21. "... has a vast fund of design ideas"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          | Disagree                 |



22. ".... is experienced in business and can discuss accounting, costing and sales methods"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

23. "....cost is not important, the best will sell"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

24. "...happiest in the Design Office, a little wary"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

25. "....not a back room boy, but is out and about and in tune with the modern world"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

26. "....is alert to safety requirements and their implications in design"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

27. ".....is a stylist to provide an acceptable face to engineering"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

28. "....personality and client-side manner are important"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

29. "....like the consumer, the Industrial Designer is very much swayed by aesthetics"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

30. "....art is all very well but the Industrial Designer must first understand the technology"

IDEAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL  
☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

31. "...is a person of extreme artistic sensitivity and discrimination"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
32. ".....talks intelligently about the product and enthuses about it"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
33. "...the logic of the product is a visual logic"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
34. ".....profit is the major motive"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
35. ".....understands the product in its total commercial context"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
36. ".....the visual is a strong point in the Industrial Designer"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
37. ".....the essential ingredients are creativity and imagination"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
38. ".....presents his ideas well and persuasively"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |
39. ".....considers it naive to bring in ideas of social responsibility - simply has a brief to fulfil"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          | Disagree                 |                          | Agree                    |                          |                          |                          |                          | Disagree                 |                          |



40. "... considers what society really needs and designs accordingly"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

41. ".....organises extreme views to effect the right decision"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

42. ".....Co-ordinates the design effort and knows enough to ask the right questions for the success of the enterprise"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

43. ".....produces a whole series of drawings to trigger the imagination"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

44. ".....has a talent for presenting well drawn design concepts"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

45. ".....relatively poor at expressing ideas in writing"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

46. ".....should have some idea of the investment required if new methods are to be introduced"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

47. ".....good in committee and understands how to make points"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

48. "....business matters waste time and energy best devoted to design"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

49. "...would like to contribute in his designs towards a better world"

IDEAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

REAL

|                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          | Disagree                 |                          |

50. ".....marketing is ultimately more potent than design"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
51. ".....is flexible and well able to put up alternative proposals for products"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
52. ".....knows exactly the characteristics and limits of materials for the product"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
53. ".....is able to design down to a price"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
54. ".....is intuitive towards other people and towards himself"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
55. ".....knows enough to ask the right people the right questions at the right time"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
56. ".... is aware of and relishes fashion"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
57. "...articulate, with a gift for presenting ideas and gaining support from management"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
58. "....comes up with ideas, but these are handed over to the Design Engineer to tool up"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |



59. "...works to dead lines and is meticulous
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
60. ".....is a boffin, not a whiz kid"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
61. "...has an ear to the ground and is aware of present and future market prospects"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
62. ".....is knowledgeable in computing, especially Computer Assisted Design"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
63. "...raises the quality of product appearance and packaging"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
64. "...aesthetics is unimportant except in its marketing implications"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
65. ".....has values that are more social than commercial"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
66. ".....the drawing's not up to much but it conveys the ideas well"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
67. ".....skilled in the appropriate market skills - psychology, display, advertising"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |
68. ".....is one amongst equals with accountants, marketing, engineers, and so on"
- |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| IDEAL                    |                          |                          |                          |                          |                          |                          | REAL                     |                          |                          |                          |                          |                          |                          |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Agree                    |                          |                          |                          |                          |                          | Disagree                 | Agree                    |                          |                          |                          |                          |                          | Disagree                 |

69. "....responsible for producing a universally elegant and acceptable product"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

70. "...given design talent, the real task of the Industrial Designer is to face up to commercial, costing and legal situations"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

71. ".....comes up with ideas, some of them possibly impractical, but unconstrained"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

72. ".....has a conscience at designing products which may prove anti-social"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

73. ".....his task is to create images and to educate the public in what it will need"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

74. ".....cost comes way behind in the list of priorities"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

75. ".....first and foremost a communicator"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

76. ".....outgoing, good with people, able to socialise freely"

IDEAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

REAL

☐ ☐ ☐ ☐ ☐ ☐  
Agree Disagree

If you feel that certain important features about the Ind. Designer or Industrial Design have not been mentioned, or if any statements seem to you to be either ambiguous or obscure, please add any comments overleaf.

Thank you for your help. Please make sure that you have ticked one box only in each set.



APPENDIX IV

THE SURVEY OF DESIGN

## SURVEY OF INDUSTRIAL DESIGN

This Survey investigates how Students and Lecturers in Industrial Design view and understand their subject. It focuses on different aspects of Design and you are asked to agree or disagree to some extent with certain statements. It is hoped that your opinions will provide a significant contribution to the understanding of the subject. Complete confidentiality is assured and the Survey will be used strictly for academic purposes.

### INSTRUCTIONS

After a brief section in which you are asked to provide some background information, there follow two main parts:

#### 1. The IDEAL Situation (page 3)

We would like you to agree or disagree with a series of statements about the Industrial Designer. Please indicate what you feel should be the Ideal position by ticking one of six boxes, corresponding to:

|                             |                          |                           |                              |                             |                                |
|-----------------------------|--------------------------|---------------------------|------------------------------|-----------------------------|--------------------------------|
| <i>Definitely<br/>Agree</i> | <i>Largely<br/>Agree</i> | <i>Slightly<br/>Agree</i> | <i>Slightly<br/>Disagree</i> | <i>Largely<br/>Disagree</i> | <i>Definitely<br/>Disagree</i> |
|-----------------------------|--------------------------|---------------------------|------------------------------|-----------------------------|--------------------------------|

#### 2. The REAL Situation (page 4)

This time you should indicate the situation as you see it existing in the REAL world. Please give your opinion by ticking one of the six boxes as shown above.

CODE \_\_\_\_\_



## BACKGROUND INFORMATION

Please tick the appropriate box or answer briefly as required.

- |    |   |          |                          |
|----|---|----------|--------------------------|
| 1. | Please give your age  | Years    | <input type="text"/>     |
| 2. | Sex (please tick box)   | Male     | <input type="checkbox"/> |
|    |   | Female   | <input type="checkbox"/> |
| 3. | Status (Please tick box)  | Student  | <input type="checkbox"/> |
|    |   | Lecturer | <input type="checkbox"/> |
| 4. | If you are a student:   |          |                          |
|    | (a) Have you already completed a Foundation Year?                 | Yes      | <input type="checkbox"/> |
|    |   | No       | <input type="checkbox"/> |
|    | (b) What year of the Industrial Design course are you now taking? | 1st      | <input type="checkbox"/> |
|    |   | 2nd      | <input type="checkbox"/> |
|    |   | 3rd      | <input type="checkbox"/> |
|    | (c) What is or was your father's occupation?                      |          |                          |
- 
5. If you are a lecturer:
- How many years have you been lecturing in this field?
- 

---

### COMMENTS

When you have completed the Survey, you may have experienced problems with some of the items, or you may wish to comment. We should be pleased to have any observations.

# THE IDEAL SITUATION

How far do you agree or disagree with the following statements? Please indicate what you feel should be the IDEAL situation by ticking ONE box only from the following choices.

| <i>Definitely<br/>Agree</i> | <i>Largely<br/>Agree</i> | <i>Slightly<br/>Agree</i> | <i>Slightly<br/>Disagree</i> | <i>Largely<br/>Disagree</i> | <i>Definitely<br/>Disagree</i> |
|-----------------------------|--------------------------|---------------------------|------------------------------|-----------------------------|--------------------------------|
|-----------------------------|--------------------------|---------------------------|------------------------------|-----------------------------|--------------------------------|

The INDUSTRIAL DESIGNER should be skilled in .....

- |   |                          |                          |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Understanding and developing a client's brief                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Creating new Design concepts                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Devising practical Design concepts                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. "Selling" the Design concept to the client                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Conceiving alternative Design solutions                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Presenting work visually                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Presenting Design concepts verbally                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Presenting Design concepts in writing                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Understanding the financial implications of Design decisions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Marketing techniques  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

The INDUSTRIAL DESIGNER should have an understanding of .....

- |   |                          |                          |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 11. Relevant engineering theory and technique | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. The Law relating to professional practice | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Normal business practice                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Relevant volume production processes      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Current market trends                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Relevant computer techniques              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

The INDUSTRIAL DESIGNER should .....

- |  |                          |                          |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 17. Work well with other Designers                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. Collaborate well with experts from other areas | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. Have initiative and be self-motivated          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Work successfully to deadlines                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. Pay attention to detail                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. Have wide cultural interests                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. Think laterally                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Be aesthetic in outlook                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Have a social conscience                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



# THE REAL SITUATION

How far do you agree or disagree with the following statements? Please give your opinion about the situation as you see it in the REAL world. Tick ONE box only from the following choices:

| <i>Definitely Agree</i> | <i>Largely Agree</i> | <i>Slightly Agree</i> | <i>Slightly Disagree</i> | <i>Largely Disagree</i> | <i>Definitely Disagree</i> |
|-------------------------|----------------------|-----------------------|--------------------------|-------------------------|----------------------------|
|-------------------------|----------------------|-----------------------|--------------------------|-------------------------|----------------------------|

The INDUSTRIAL DESIGNER is skilled in .....

- |  |                          |                          |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Understanding and developing a client's brief                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Creating new Design concepts                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Devising practical Design concepts                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. "Selling" the Design concept to the client                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Conceiving alternative Design solutions                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Presenting work visually                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Presenting Design concepts verbally                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Presenting Design concepts in writing                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Understanding the financial implications of Design decisions. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Marketing techniques   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

The INDUSTRIAL DESIGNER has an understanding of .....

- |  |                          |                          |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 11. Relevant engineering theory and techniques | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Law relating to professional practice      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Normal business practice                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Relevant volume production processes       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Current market trends                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Relevant computer techniques               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

The INDUSTRIAL DESIGNER .....

- |   |                          |                          |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 17. Works well with other Designers                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. Collaborates well with experts from other areas | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. Has initiative and is self-motivated            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Works successfully to deadlines                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. Pays attention to detail                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. Has wide cultural interests                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. Thinks laterally                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Is aesthetic in outlook                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. Has a social conscience                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

APPENDIX V

THE SURVEY OF VALUES (SSV)



## The Survey of Values (SSV)

The Survey of Values was developed (Solomons 1970) to study differences between Arts and Science Sixth Form students. Six value systems were proposed:

Theoretic, Pragmatic, Aesthetic, Social, Dominant, and Metaphysic

In the SSV these value systems are regarded as filters or lenses through which the individual perceives the world and by which he mediates his reactions to the world. In practice they all play their part and thus the individual views the world, as it were, through a compound lens made up of varying strengths of values.

These were not arbitrary systems and they derive from the classification of Spranger (1928). He postulated six ideal types of individual:

Theoretical, Economic, Aesthetic, Social, Political, and Religious

Spranger's types represent more or less consistent and permanent attitudes and have proved seminal. They are in fact the bases of the Study of Values by Allport, Vernon & Lindzey (Allport 1960).

Solomons was dealing with a highly selected population and a greatly changed society from that of Spranger, and it was considered advisable to amend and to redefine certain of the terms used by Spranger. These definitions follow:

### Descriptions of Values as used in the SSV

#### a. THEORETIC

The Theoretic person is concerned with knowledge pure and simple of the external world. To this end he analyses phenomena and abstracts their points of resemblance and difference. Knowledge for him is the dominant interest and it is synonymous with the process of analysis and comparison. So that the process may be valid and public, he tries as far as possible to eliminate all subjective judgements and all judgements concerning the beauty and utility of the objects which he is studying.

b. PRAGMATIC

The Pragmatic person is concerned with utility. Knowledge by itself is not of value; it acquires value by dint of being used and being useful. This attitude possibly takes its origin in the need to survive and the consequent need to behave in practical way. This attitude is transformed into a preoccupation with economic, financial and business matters. Possessions and ostentatious possessions, "keeping up with the Joneses" - all these are symptomatic of this value.

c. SOCIAL

For the social person, people matter. All other things - money, truth, beauty - are subordinate to this. Personal relations, the "I-Thou" situation, group activities, the need for people to love one another and to treat each other with affectionate respect - all these things are valuable. There is no devotion to far-off Goodness or Truth; this is immediate, here and now. Persons are valuable in their own right and are to be treated as ends and not as means to ends.

d. AESTHETIC

The aesthetic person is appreciative of the pattern of things, their harmony and form. There is not so much concern to understand anything rationally - rather the immediate impression of the whole configuration is felt. Logic and discursive reason are necessary only for the continuance of interest. There is no need to be creative as such - merely to be intensely aware of events and to enjoy them for their own sake.

e. DOMINANT

The dominant person needs power. It is possible that this need is a compensation for a sense of insecurity in a potentially hostile universe, but whatever the origin, it is usually well hidden. This person excels in situations where office and the control of people is involved. Struggle and competition are natural and vital and personal power and fame are the ends.



f. METAPHYSIC

For the metaphysic person, subjective and objective link into one whole. The highest value is the sense of the unity of all things. The subjective order of things is not despised as in the THEORETIC, nor the rational as in the AESTHETIC. There is a synthesis of all the faculties, rising sometimes to a mystic contemplation of the universe. In this sense there are religious affinities, although it does not necessarily involve a Deity. The vested wisdom of the culture is important, along with a poignant sense of moral and ethical duty.

An example of the Survey of Values follows:

## SURVEY OF VALUES

This survey is an attempt to find out what kind of ideas and things you think are valuable. It is confidential because we would like you to be completely frank in your replies. For this reason you are not asked to put your name.

The survey is divided into two parts:

PART I is purely factual and you are asked to answer the questions either by ticking your choice or by giving a very short reply.

PART II consists of 45 questions. Each question has three points and you are asked to allocate these three points according to your degree of preference, and to put the scores in the circles to the right. You may not fully agree with either of the choices open to you. Nevertheless you will make the best possible choice from what is offered. The following points are possible ways in which you may score:

|    | a. | b.              |
|----|----|-----------------|
|    | 3  | 0               |
|    | 2  | 1               |
|    | 1  | 2               |
|    | 0  | 3               |
| or | 1½ | 1½ if desperate |

THERE IS NO TIME LIMIT FOR THIS SURVEY

Please turn to Part I



SURVEY OF VALUES

PART I

SEX \_\_\_\_\_ DATE OF BIRTH \_\_\_\_\_

SCHOOL \_\_\_\_\_

1. What subjects are you studying now for A level?
2. At what age did you begin to specialise in these subjects?
3. Was your present choice of subjects determined by:
  - (a) The prospect of greater salary in a future job.
  - (b) Past success in these particular subjects.
  - (c) Advice or influence by teachers of these subjects.
  - (d) Advice or influence of parents.
4. Was there any possibility of taking a combination of subjects from (say) Arts or Sciences?
5. Do you feel now that you might have made a wrong choice of subjects?
6. If you would be willing to discuss any of your answers further please put your name.

Name \_\_\_\_\_

## SURVEY OF VALUES PART II

1. If we are to restore faith to men, it will be through science. Do you:
  - a. Disagree
  - b. Agree .
2. Which statement do you prefer:
  - a. There is power in beauty
  - b. There is beauty in power
3. In the event of nuclear war, what would you regard as more important to preserve for the survivors:
  - a. Moral and ethical ideas
  - b. Techniques and useful knowledge .
4. Should a scientist allow ideas of social responsibility to influence his work:
  - a. No
  - b. Yes
5. Whom do you admire more:
  - a. Socrates
  - b. Napoleon
6. If you were a teacher and had the necessary ability, would you prefer to teach:
  - a. Poetry
  - b. Maths
7. Most people enjoy the inferiority of their best friends. Do you agree with this:
  - a. Yes
  - b. No
8. Do you think:
  - a. That some values are linked to usefulness, but that others belong purely to morals and ethics.
  - b. That values are inevitably linked to use, and that men value only the things or ideas that are useful.

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| L | M | N | X | Y | Z |

PLEASE INSERT SCORES IN CIRCLES AND THE TOTALS OF THE VERTICAL COLUMNS AT THE FOOT OF THE PAGE.



9. The object of learning a scientific subject is:
  - a. To gain knowledge about natural phenomena
  - b. To enable one to control the forces of nature
10. Which quality is preferable in a companion of the opposite sex:
  - a. Good looks
  - b. Ability to mix well with people.
11. With which of the following statements would you agree:
  - a. The task of Science is to provide in detail knowledge about the world
  - b. The task of Science is to provide a set of working hypotheses in order to greater control over events
12. One cannot afford to become involved with people if one wishes to understand them and improve their lot.
  - a. Agree
  - b. Disagree
13. Is it better to spend one's leisure in:
  - a. Concern for the welfare of others
  - b. Reflection and contemplation of one's inner self
14. Which of these traits of character would you prefer in a friend:
  - a. Drive and "personality".
  - b. Intuitive and complete appreciation of life
15. If you were in a position to do so, would you prefer to raise:
  - a. Standards of intelligence
  - b. Standards of taste
16. Do you regard with sympathy the Eastern idea that one must renounce individuality before one can attain complete life;
  - a. No
  - b. Yes

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| L | M | N | X | Y | Z |

- 17 Would you prefer:
- a. A job with high wages but little social prestige, e.g. a docker or shorthand typist
  - b. A job with lower salary but higher prestige, e.g. a probation officer or a nurse
- 18 The major trouble with the civilisation of today is that it manufactures but does not create.
- a. Disagree
  - b. Agree
- 19 What is more really more important to You:
- a. A secure friend
  - b. A secure job
- 20 In a paper such as the Sunday Times or the Observer, do you normally turn first to articles on:
- a. Books, painting or drama
  - b. Political issues
- 21 Moral judgement and wisdom must ultimately be based on scientific facts. Do you:
- a. Disagree
  - b. Agree
- 22 Do you prefer:
- a. To win friends
  - b. To influence people
- 23 Beauty is a luxury in our civilisation and must take second place to utility. Do you:
- a. Agree
  - b. Disagree
- 24 Do you think of a scientist as interested primarily in:
- a. Knowledge for its own sake
  - b. Knowledge for the control of man's environment

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| L | M | N | X | Y | Z |





32. It has been said that people are more important than principles. Which do you consider more important:  
a. Principles                      b. People
33. Do you think that:  
a. Individuals can control the course of events  
b. Individuals are governed by events
34. Would you be more interested in discussing:  
a. Is Modern Art sincere?  
b. Is there a purpose in Life?
35. Truth is not enough, it must be useful truth. Do you agree:  
a. Yes                                  b. No
36. Who would you rather have been:  
a. Alexander the Great    b. Mozart
37. Do you tend:  
a. To make careful plans for your future, keeping an eye on your financial position  
b. To take each day as it comes, enjoying it as you can, but not worrying overmuch about tomorrow.
38. Which of the following is nearer to the truth:  
a. Human activity and aspiration may ultimately be traced back to the urge to compete  
b. Human activity and aspiration may ultimately be traced forward to the desire to understand the world as a whole and man's place in it

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| L | M | N | X | Y | Z |



39. Knowledge is something to be used. Do you regard knowledge primarily in this way:  
a. Yes                      b. No
40. Should education be concerned more with:  
a. Discrimination in matters of taste  
b. Producing the ideal citizen
41. Some people prefer possessions, some prefer influence. Which assumes more prominence in your life:  
a. Influence              b. Possessions
42. Do you think the word "ought" implies:  
a. A duty not determined by others and answerable ultimately to oneself  
b. A compromise between your wishes and the wishes of others
43. Which seems more important to you:  
a. That a thing should fulfil some useful purpose  
b. That it should be beautiful
44. In any action, what weighs more heavily with you:  
a. What it will cost  
b. What people think
45. "Poetry can convey a kind of truth that prose cannot." Do you agree:  
a. Yes                      b. No

|   |   |   |   |   |   |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| L | M | N | X | Y | Z |

APPENDIX VI

STATISTICAL METHODS



## MULTIDIMENSIONAL SCALING ANALYSIS

## MULTIDIMENSIONAL SCALING

A slightly more technical exposition of programs SSA1 and MSA1 from the Guttman-Lingoes series follows, together with examples of plots and diagrams from the present study.

### SMALLEST SPACE ANALYSIS (SSA1)

The Guttman-Lingoes Smallest Space Analysis presents a geometrical representation of the correlation matrix based on the order of the magnitude of the intercorrelations among the variables. The differences in magnitude are expressed as distances between pairs of points such that they are closer together if the correlation is high.

SSA attempts to find the space with the minimum number of dimensions in which the rank order of correlation is preserved.

The goodness of fit of a solution in a given space is measured by a coefficient of alienation  $(1-r^2)^{1/2}$  where  $r$  is a rank order correlation between the variables' intercorrelation and their corresponding distances. The smaller the coefficient of alienation, the better the fit. Zero represents a perfect fit. A coefficient of alienation less than 0.17 is regarded as satisfactory.

### MULTIDIMENSIONAL SCALOGRAM ANALYSIS (MSA1)

The Guttman-Lingoes Multidimensional Scalogram Analysis I is particularly applicable to qualitative or categorical data, where each person, object or type is represented by a vector of categories within variables. The version currently available is limited to 99 cases and for this reason this study has made use of a random sample of 99 from its 204 cases.

As in the Smallest Space program, the basic aim is to determine the smallest space in which to represent the order implicit in the data.



MSA is concerned with persons, variables and categories within variables. In contrast with SSA which reproduces order relations, MSA conserves class membership.

No assumptions are made about metric, scale or ordinal properties of the data nor about underlying distributions.

MSA maps persons into an Euclidean space of minimal dimensionality. Persons are represented as points in space, each variable as a partition of the space into non-overlapping regions and each category or structuple as a region of the space. Regional boundaries may assume any shape.

If regions are revealed that exhaustively defined all the structuples and lines divided absolutely one set from another, then this is termed a "first order contiguity". A measure of this clear division is given by the coefficient of contiguity which ranges from +1 to -1, that is from perfection to complete discrepancy. Perfect partitioning is rare and normally a coefficient of around +0.9 is considered satisfactory.

MSA enables the researcher to discriminate between contiguity regions, although the shape of the partition lines may change from variable to variable. A guide to the position of these lines is provided by calculating indices of Selectivity and Sensitivity, definitions of which have been given in Chapter 8.4.

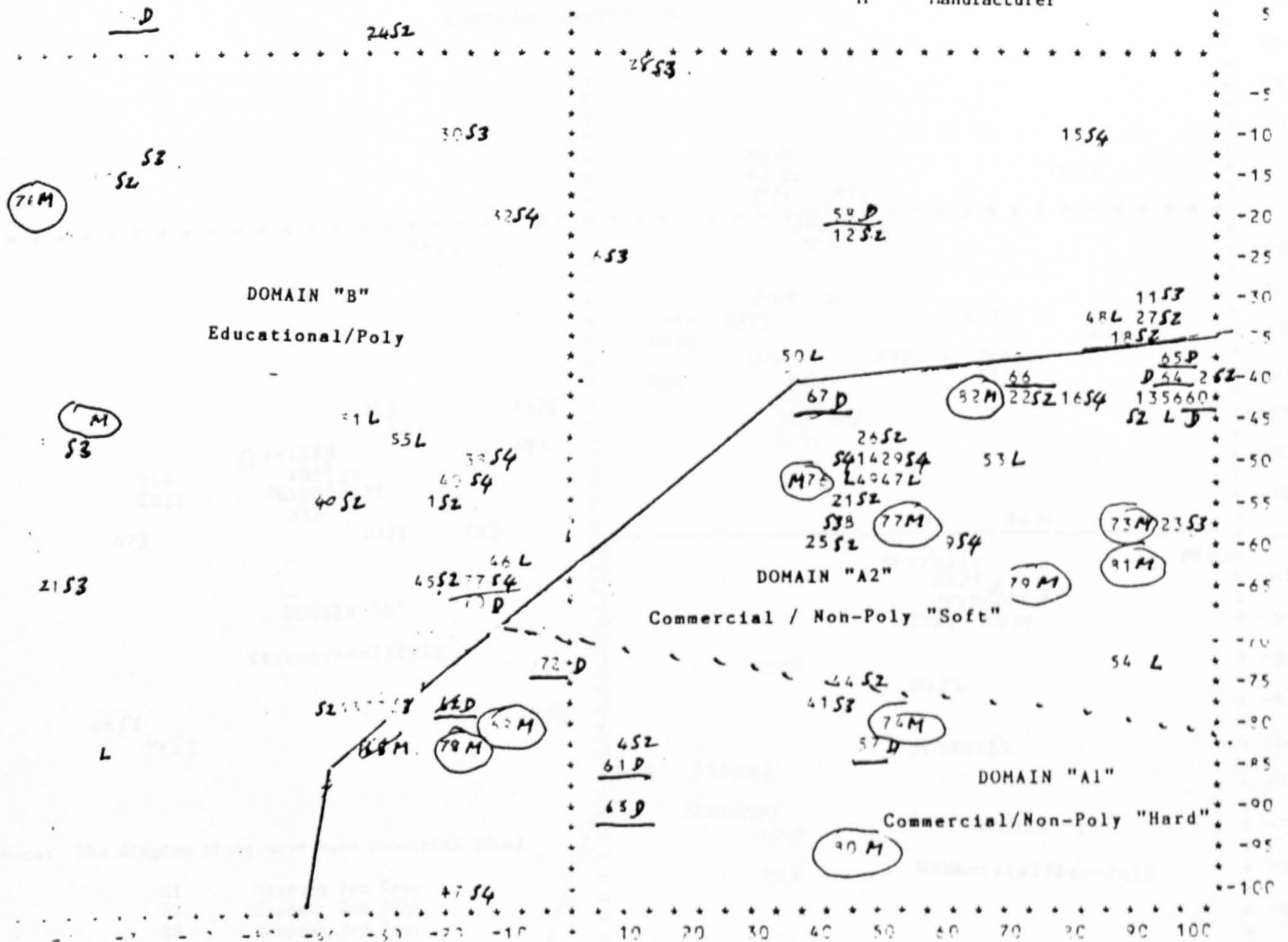
Examples of MSA1 Space diagrams follow showing partitions from which are derived the schematic versions of Diagrams 14, 14A, 15, 15A in the main text.

# MULTIDIMENSIONAL SCALOGRAM ANALYSIS

## SPACE DIAGRAM COMPLETE SAMPLE IDEAL

Note: The diagram plots have been annotated thus:

S2 Student 1st Year/  
S3 Student 2nd Year  
S4 Student 3rd Year  
L Lecturer  
D Designer  
M Manufacturer

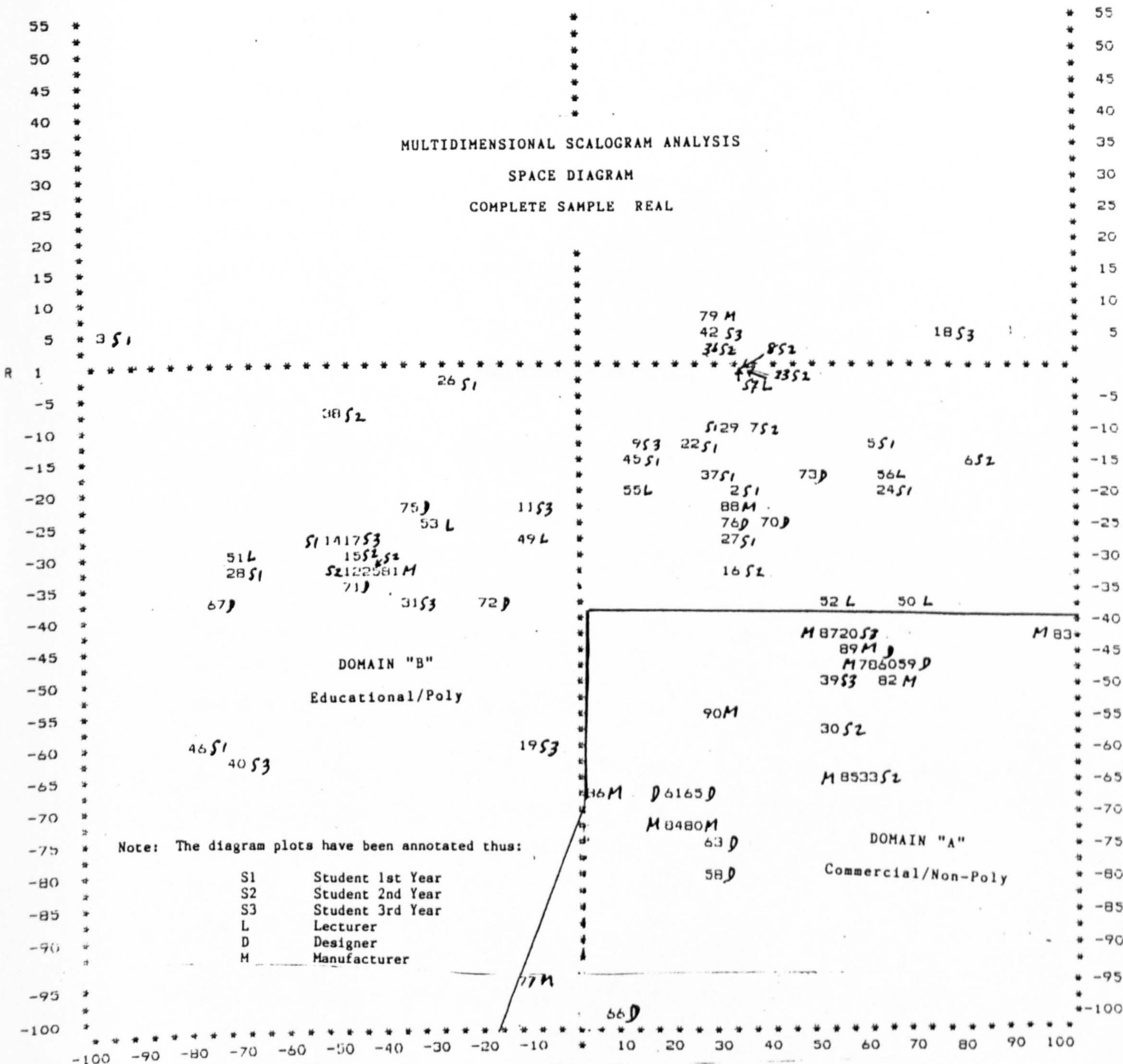




# MULTIDIMENSIONAL SCALOGRAM ANALYSIS

## SPACE DIAGRAM

COMPLETE SAMPLE REAL



## LOGLINEAR ANALYSIS



## Loglinear Analysis

A slightly more technical exposition of the details of the Log Linear technique follows, together with examples and computer print out from SPSS HILOGLINEAR runs.

If the raw data from all the instruments used in the research are expressed in frequency counts and assembled in appropriate contingency tables then the associations between certain variables or certain combinations of variables may be explored.

The basic method used to assess the strength of association is to compare what is actually observed with a theoretical measure which might be expected. Two theoretical criteria may be used:

$$\text{Chi Squared} = \sum (O - E)^2 / E$$

$$G \text{ Squared (Likelihood Ratio)} = 2 \sum (O \times \log O) / E$$

Both Chi Squared and G Squared may be used to assess evidence of strength of association, but give no indication of its direction.

These two statistics provide a means of testing whether a particular set of Expected Frequencies, based on a particular assumption or model adequately fits the data.

In the case of a Two Way table, for example, the standard procedure is to calculate the Expected frequencies on the assumption of independence, that is that no association exists between the variables. The rejection of this model is therefore a rejection of the Independence Assumption.

When the number of variables is increased so does the number of possible models. There is a need to model the various permutations of associations which are possible, ranging from the model of complete independence to that of complete association between the variables.

In this more complex situation G Squared provides a method of exploring these models. In particular it is possible to compare nested models in which progressively terms are added (or deleted). To examine the need for these terms the consequent change in G Squared is compared with Chi Squared associated with the change in degrees of freedom.

In the simplest case, that of two variables, there are therefore only two possible models:

Independent   a   b  
or  
Full or Saturated    $a*b = a+b+a*b$

The Saturated model will exactly fit the observed data and in this case G Squared = 0 and Degrees of Freedom = 0. The change in G Squared between the two models, that is the difference between Independent and Saturated, will therefore equal G Squared for the Independent model. Hence the rejection of the Independent model implies the need for the association term  $a*b$ .

In the case of larger tables, say with three variables a,b,c the range of possible nested models is as follows:

|                      |             |
|----------------------|-------------|
| From the Independent | a b c       |
|                      | a*c b       |
|                      | a*b c       |
|                      | b*c a       |
|                      | a*c a*b     |
|                      | b*c a*b     |
|                      | b*c a*c     |
|                      | a*b a*c b*c |
| To the Saturated     | a*b*c       |



A possible procedure, called Backward Elimination may be used in exploring these various models starting with the Saturated model deleting terms progressively, and testing change in G Squared at each stage. This presupposes that no significant terms will be deleted, that no model should contain unnecessary or redundant terms and that the final model adopted should fit in absolute terms.

In this study Backwards Elimination is used and SPSS HILOGLINEAR has a Backwards option which deletes unnecessary terms to arrive at a parsimonious description of the relationships within the data. An example of computer printout from this program follows.

The raw data or transformation pass is proceeding  
 12 cases are written to the uncompressed active file.  
 HILOGLINEAR requires 712 BYTES of workspace for execution.

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\*\*\*\*\* H I E R A R C H I C A L L O G L I N E A R \*\*\*\*\*

# DATA Information

12 unweighted cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 12 weighted cases will be used in the analysis.

# FACTOR Information

| Factor | Level | Label                         |
|--------|-------|-------------------------------|
| HYRE   | 2     | HIGH REAL TOTALS              |
| ATTRE  | 2     | ATTITUDES AT WORK REAL TOTALS |
| VALRE  | 2     | VALUES REAL TOTALS            |

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DESIGN 1 has generating class

HYRE\*ATTRE\*VALRE

The Iterative Proportional Fit algorithm converged at iteration 1.  
 The maximum difference between observed and fitted marginal totals is 0.0  
 and the convergence criterion is .250

# Observed, Expected Frequencies and Residuals.

| Factor | Code | OBS count | EXP count |
|--------|------|-----------|-----------|
| HYRE   | 0    |           |           |
| ATTRE  | 0    |           |           |
| VALRE  | 0    | 4.0       | 4.0       |
| VALRE  | 1    | 3.0       | 3.0       |

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| Factor | Code | OBS count | EXP count |
|--------|------|-----------|-----------|
| ATTRE  | 1    |           |           |
| VALRE  | 0    | 0.0       | 0.0       |
| VALRE  | 1    | 2.0       | 2.0       |
| HYRE   | 1    |           |           |
| ATTRE  | 0    |           |           |
| VALRE  | 0    | 0.0       | 0.0       |
| VALRE  | 1    | 1.0       | 1.0       |
| ATTRE  | 1    |           |           |
| VALRE  | 0    | 0.0       | 0.0       |
| VALRE  | 1    | 2.0       | 2.0       |

# Goodness-of-fit test statistics

Likelihood ratio chi square = 0.0 DF = 0 P = 1.000  
 Pearson chi square = 0.0 DF = 0 P = 1.000

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Tests that K-way and higher order effects are zero.

| K | DF | L.R. Chisq | Prob   | Pearson Chisq | Prob   | Iteration |
|---|----|------------|--------|---------------|--------|-----------|
| 3 | 0  | .000       | 1.0000 | .000          | 1.0000 | 3         |
| 2 | 4  | 7.638      | .1038  | 7.000         | .1359  | 2         |
| 1 | 7  | 13.496     | .0609  | 10.667        | .1538  | 0         |

Tests that K-way effects are zero.

| K | DF | L.R. Chisq | Prob   | Pearson Chisq | Prob   | Iteration |
|---|----|------------|--------|---------------|--------|-----------|
| 1 | 3  | 5.858      | .1187  | 3.667         | .2998  | 0         |
| 2 | 4  | 7.638      | .1038  | 7.000         | .1359  | 0         |
| 3 | 0  | .000       | 1.0000 | .000          | 1.0000 | 0         |

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Backward Elimination for DESIGN 1 with generating class

HYRE\*ATTRE\*VALRE

Likelihood ratio chi square = 0.0 DF = 0 P = 1.000

If Deleted Simple Effect is DF L.R. Chisq Change Prob Iter

HYRE\*ATTRE\*VALRE VI - 11 .000 1.0000 3



--exp .

The best model has generating class

HYRE\*ATTRE  
HYRE\*VALRE  
ATTRE\*VALRE

Likelihood ratio chi square = .00000 DF = 0 P = 1.000

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| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| HYRE*ATTRE                  | 1  | .541              | .4620 | 2    |
| HYRE*VALRE                  | 1  | 1.530             | .2162 | 2    |
| ATTRE*VALRE                 | 1  | 2.805             | .0940 | 2    |

Step 2

The best model has generating class

HYRE\*VALRE  
ATTRE\*VALRE

Likelihood ratio chi square = .54115 DF = 1 P = .462

| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| HYRE*VALRE                  | 1  | 2.911             | .0880 | 2    |
| ATTRE*VALRE                 | 1  | 4.186             | .0408 | 2    |

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Step 3

The best model has generating class

ATTRE\*VALRE  
HYRE

Likelihood ratio chi square = 3.45219 DF = 2 P = .178

| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| ATTRE*VALRE                 | 2  | 4.186             | .1233 | 2    |
| HYRE                        | 1  | 3.139             | .0764 | 2    |

Step 4

The best model has generating class

HYRE  
ATTRE  
VALRE

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Likelihood ratio chi square = 7.63817 DF = 4 P = .106

| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| HYRE                        | 1  | 3.139             | .0764 | 2    |
| ATTRE                       | 1  | 1.359             | .2437 | 2    |
| VALRE                       | 1  | 1.359             | .2437 | 2    |

Step 5

The best model has generating class

HYRE  
VALRE

Likelihood ratio chi square = 8.99736 DF = 3 P = .109

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| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| HYRE                        | 1  | 3.139             | .0764 | 2    |
| VALRE                       | 1  | 1.359             | .2437 | 2    |

Step 6

The best model has generating class

HYRE

Likelihood ratio chi square = 10.35656 DF = 6 P = .110

| If Deleted Simple Effect is | DF | L.R. Chisq Change | Prob  | Iter |
|-----------------------------|----|-------------------|-------|------|
| HYRE                        | 1  | 3.139             | .0764 | 0    |

## Step 7

The best model has generating class

Likelihood ratio chi square = 13.49604 DF = 7 P = .061

## Step 8

The best model has generating class

Likelihood ratio chi square = 13.49604 DF = 7 P = .061

The final model has generating class

The Iterative Proportional Fit algorithm converged at iteration 0.  
The maximum difference between observed and fitted marginal totals is 1.500  
and the convergence criterion is .250

Observed, Expected Frequencies and Residuals.

| Factor | Code | OBS count | EXP count |
|--------|------|-----------|-----------|
| HYRE   | 0    |           |           |
| ATTRE  | 0    |           |           |
| VALRE  | 0    | 4.0       | 1.5       |
| VALRE  | 1    | 3.0       | 1.5       |
| ATTRE  | 1    |           |           |
| VALRE  | 0    | 0.0       | 1.5       |

| Factor | Code | OBS count | EXP count |
|--------|------|-----------|-----------|
| VALRE  | 1    | 2.0       | 1.5       |
| HYRE   | 1    |           |           |
| ATTRE  | 0    |           |           |
| VALRE  | 0    | 0.0       | 1.5       |
| VALRE  | 1    | 1.0       | 1.5       |
| ATTRE  | 1    |           |           |
| VALRE  | 0    | 0.0       | 1.5       |
| VALRE  | 1    | 2.0       | 1.5       |

Goodness-of-fit test statistics

Likelihood ratio chi square = 13.49604 DF = 7 P = .061  
Pearson chi square = 10.66667 DF = 7 P = .154

This procedure was completed at 18:19:01

C&gt;



NEWMAN-KEULS TREND ANALYSIS

### Appendix Trend Analysis using Newman-Keuls procedures

The means set out below are from scores obtained by five independent groups of students on the Survey of Values.

The groups in question were:

1. Industrial Design - Polys of Leicester, Teesside and Central School of Art & Design, London
2. Social Workers - Leicester University
3. Fine Arts - Leics Poly
4. Business Studies - Leics Poly
5. Maths - Leics University

Newman-Keuls procedures (see Sachs 1984) localised the major sources of variance within each value as follows:

Summary Table of Means

| GROUP | THEORETICAL | PRAGMATIC | AESTHETIC | SOCIAL | DOMINANT | N   |
|-------|-------------|-----------|-----------|--------|----------|-----|
| 1     | 19.125      | 22.000    | 23.539    | 27.633 | 20.125   | 133 |
| 2     | 16.731      | 19.192    | 22.981    | 29.981 | 20.154   | 52  |
| 3     | 18.612      | 16.122    | 30.429    | 31.408 | 14.653   | 49  |
| 4     | 20.698      | 27.491    | 19.943    | 23.377 | 21.604   | 53  |
| 5     | 24.633      | 22.061    | 17.449    | 27.388 | 19.388   | 49  |

The above means were examined for significant differences with the Newman-Keuls procedure. This uses the q statistic of the Studentised Range tables in terms of the distance between ordered means and also the degrees of freedom of the Means Square error of the sample. This tabular q is then tailored to fit the specific comparison between means by multiplying the square root of the Mean Square error divided by n, that is the number of cases for the particular variable.



The resultant "tailored"  $q$  is then compared with the observed difference (range) between the sample means. If this observed difference exceeds the "tailored"  $q$ , then it is significant at an appropriate level of probability and specific hypotheses may be rejected.

### Tabular $q$

There are five Student groups:

Industrial Design (ID), Social Workers (S), Fine Arts (FA), Business Studies (B), and Maths (M) and therefore there is a maximum of four steps between them.

| Steps $r=$        | 2    | 3    | 4    |
|-------------------|------|------|------|
| $q_{.95}(r, 326)$ | 2.77 | 3.31 | 3.63 |
| $q_{.99}(r, 326)$ | 3.64 | 4.12 | 4.40 |

### THEORETIC VALUE

#### Ordered means

|    | 1.S    | 2.FA   | 3.ID    | 4.B     | 5.M     |
|----|--------|--------|---------|---------|---------|
|    | 16.731 | 18.612 | 19.125  | 20.698  | 24.633  |
| 1. | /      | 1.881* | 2.394** | 3.967** | 7.902** |
| 2. |        | /      | 0.513   | 2.086*  | 6.02**  |
| 3. |        |        | /       | 1.573   | 5.505** |
| 4. |        |        |         | /       | 3.935** |
| 5. |        |        |         |         | /       |

The normal conventions apply:

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

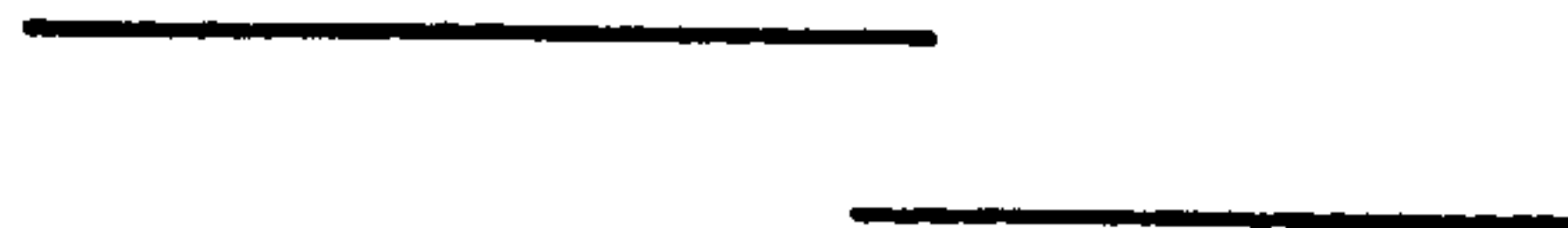
Common underlining indicates means do not differ significantly.

# THEORETIC "tailored" q

|             |      |      |     |
|-------------|------|------|-----|
| Steps r=    | 2.   | 3.   | 4.  |
| q.95(r,326) | 1.76 | 2.10 | 2.3 |
| q.99(r,326) | 2.31 | 2.61 | 2.8 |

This would indicate that there are extensive differences between the means with the M group significantly different from all the others ( $p < .01$ ) and others spaced significantly. There is no significant difference between FA and ID and between ID and B on this Theoretic value.

|   |    |    |   |   |
|---|----|----|---|---|
| S | FA | ID | B | M |
|---|----|----|---|---|



## PRAGMATIC VALUE

### Ordered means

|    |        |        |         |         |          |
|----|--------|--------|---------|---------|----------|
|    | 1.FA   | 2.S    | 3.ID    | 4.M     | 5.B      |
|    | 16.122 | 19.192 | 22.00   | 22.061  | 27.491   |
| 1. | /      | 3.07** | 5.878** | 5.939** | 11.369** |
| 2. |        | /      | 2.808** | 2.869** | 8.299**  |
| 3. |        |        | /       | 0.061   | 5.491**  |
| 4. |        |        |         | /       | 5.43**   |
| 5. |        |        |         |         | /        |



# PRAGMATIC "tailored" q

| Steps r=    | 2    | 3    | 4    |
|-------------|------|------|------|
| q.95(r,326) | 1.82 | 2.18 | 2.39 |
| q.99(r,326) | 2.40 | 2.71 | 2.90 |

Significant differences exist , all at the 1% level, between all groups except Maths and Industrial Design, whose means lie close to the overall mean.

FA                  S                  ID                  M                  B

## AESTHETIC VALUE

### Ordered Means

|    | 1.M    | 2.B     | 3.S     | 4.ID    | 5.F.     |
|----|--------|---------|---------|---------|----------|
|    | 17.449 | 19.943  | 22.981  | 23.539  | 30.429   |
| 1. | /      | 2.494** | 5.532** | 6.09**  | 12.98**  |
| 2. |        | /       | 3.038** | 3.596** | 10.486** |
| 3. |        |         | /       | 0.558   | 7.448**  |
| 4. |        |         |         | /       | 6.89**   |
| 5. |        |         |         |         | /        |

## AESTHETIC "tailored" q

| Steps r=    | 2.    | 3.    | 4.    |
|-------------|-------|-------|-------|
| q.95(r,326) | 1.931 | 2.307 | 2.53  |
| q.99(r,326) | 2.537 | 2.872 | 3.067 |

Significant differences exist between all groups except Social and Industrial Design.

M                  B                  S                  ID                  FA

# SOCIAL VALUE

## Ordered Means

|    | 1.B    | 2.M    | 3.ID    | 4.S     | 5.FA    |
|----|--------|--------|---------|---------|---------|
|    | 23.377 | 27.388 | 27.633  | 29.981  | 31.408  |
| 1. | /      | 4.01** | 4.256** | 6.604** | 8.031** |
| 2. |        | /      | 0.245   | 2.593*  | 4.02**  |
| 3. |        |        | /       | 2.348** | 3.779** |
| 4. |        |        |         | /       | 1.427   |
| 5. |        |        |         |         | /       |

## SOCIAL "tailored" q

| Steps r =   | 2    | 3    | 4    |
|-------------|------|------|------|
| q.95(r,326) | 1.78 | 2.13 | 2.33 |
| q.99(r,326) | 2.34 | 2.65 | 2.83 |

Business Studies is significantly lower than all the other groups.  
 Maths and Industrial together form a subset which in turn is  
 significantly lower than the top subset of Social and Fine Arts.

| B | M     | ID | S     | FA |
|---|-------|----|-------|----|
|   | _____ |    | _____ |    |



# DOMINANT VALUE

## Ordered Means

|    | 1.FA   | 2.M     | 3.ID    | 4.S     | 5.B     |
|----|--------|---------|---------|---------|---------|
|    | 14.653 | 19.388  | 20.125  | 20.154  | 21.604  |
| 1. | /      | 4.735** | 5.472** | 5.501** | 6.951** |
| 2. |        | /       | 0.737   | 0.766   | 2.216*  |
| 3. |        |         | /       | 0.029   | 1.479   |
| 4. |        |         |         | /       | 1.45    |
| 5. |        |         |         |         | /       |

## DOMINANT "Tailored" q

| Steps r =   | 2     | 3     | 4     |
|-------------|-------|-------|-------|
| q.95(r,326) | 1.654 | 1.976 | 2.167 |
| q.99(r,326) | 2.173 | 2.460 | 2.627 |

Fine Arts is significantly lower at the 1% level than all other groups

| FA | M | ID | S | B |
|----|---|----|---|---|
|    |   |    |   |   |

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PRINCIPAL COMPONENTS ANALYSIS AND RESULTS



## Principal Components Analysis

### Survey of Design

This is a Multivariate technique of deriving a smaller number of components to represent a larger number of tests. The method assumes that all the variance of all the tests may be assigned to the common components to be extracted. There is no attempt to keep either the error variance or the specific variance of the tests out of the components. The components extracted are orthogonal or uncorrelated.

After the 1st component is extracted the Eigenvalue may be calculated and this often serves as a criterion for retaining or discarding the analysis, since from it the proportion of the total variance explained by the factor may be calculated. As a working rule, components with an Eigenvalue of less than 1 are not worth considering.

The general use of Principal Components is to explore the patterning of variables, to test hypotheses about this patterning and as a summary device to construct simpler components for future testing.

#### IDEAL

| Group     | Eigenvalue  | %    | Components | Cumulative % |
|-----------|-------------|------|------------|--------------|
| Students  | 7.11297     | 28.5 | 8          | 66.2         |
| Lecturers | No analysis |      |            |              |
| Designers | No analysis |      |            |              |
| Manfrs    | 11.04642    | 44.2 | 6          | 87.9 *       |
| Year 1    | 7.83684     | 31.3 | 7          | 69.7         |
| Year 2    | 8.40356     | 33.6 | 7          | 79.8         |
| Year3     | 6.84905     | 27.4 | 8          | 78.0         |
| Year 4+5  | 7.46766     | 29.9 | 8          | 82.3         |
| Leics P   | 6.55307     | 26.2 | 9          | 75.9         |
| Teesside  | 6.9142      | 27.7 | 8          | 72.1         |
| London    | 7.22295     | 28.9 | 7          | 73.5         |

# REAL

| Group     | Eigenvalue | %    | Components | Cumulative % |
|-----------|------------|------|------------|--------------|
| Students  | 6.836      | 27.3 | 8          | 67.6         |
| Lecturers | 12.88      | 51.5 | 6          | 88.6 *       |
| Designers | 10.4491    | 41.8 | 6          | 76.3 *       |
| Manfrs    | 10.1505    | 40.6 | 6          | 90.7 *       |
| Year1     | 6.58399    | 26.3 | 7          | 70.1         |
| Year2     | 7.10087    | 28.4 | 8          | 79.8         |
| Year3     | 6.76825    | 27.1 | 8          | 79.4         |
| Year4+5   | 9.61869    | 38.5 | 7          | 81.8 *       |
| Leics P   | 9.00375    | 36.0 | 7          | 74.0 *       |
| Teesside  | 5.86348    | 23.5 | 8          | 72.7         |
| London    | 6.51041    | 26.0 | 9          | 79.3         |

This is a complex set of data and an indication of this complexity is to be found with the number of Components identified and the spread of variability right throughout the Components. A lead to the structure is to be found in the Eigenvalues and the percentage covered by the first Component.

In IDEAL the only group of note is Manufacturers with an Eigenvalue of 11.0462. In this group the first Component out of six Factors represents 44.2% of the variability. The other groups in IDEAL have no such significant Eigenvalue nor Component 1, and in fact no analysis at all emerges for Lecturer or Designers. It may only be concluded that Students, as opposed to Manufacturers are far more varied in conceptual model.

In REAL there is also a net difference between Students and the other groups, with Years 1,2, and 3. There seems also a difference between undergraduate and post graduate Students, with more affinity between the latter and the other groups.



The situation is simpler with Manufacturers (Eigenvalue 10.1505), Lecturers (Eigenvalue 12.88) and Designers (Eigenvalue 10.4491). While any concise interpretation of these results is difficult, there would seem to be differences between Undergraduates, Postgraduates, Lecturers, Designers and Manufacturers. This is in line with results emerging from the MSA and Loglinear analyses in the latter part of the study.

# PRINCIPAL COMPONENTS ANALYSIS

## SURVEY OF DESIGN

### STUDENTS - IDEAL

#### Factor Score Coefficient Matrix:

|          | FACTOR 1 | FACTOR 2 | FACTOR 3 |
|----------|----------|----------|----------|
| HYID1    | -.02611  | -.03555  | -.05563  |
| HYID2    | -.11696  | -.00156  | -.04744  |
| HYID3    | .10741   | -.12182  | -.02110  |
| HYID4    | -.07253  | -.10089  | -.01250  |
| HYID5    | -.04730  | -.00890  | -.16542  |
| FRAGID6  | .06393   | .10325   | .04871   |
| FRAGID7  | -.12654  | -.04366  | -.04738  |
| FRAGID8  | -.00792  | -.03007  | .00575   |
| FRAGID9  | .25734   | -.03656  | .04260   |
| FRAGID10 | .10921   | -.03644  | .02814   |
| BACKID11 | .36233   | -.22516  | -.02062  |
| BACKID12 | .28012   | -.04157  | -.08053  |
| BACKID13 | .23438   | .12252   | -.03841  |
| BACKID14 | .14030   | .13797   | -.09408  |
| BACKID15 | .01874   | -.01297  | -.12302  |
| BACKID16 | .09819   | -.08052  | .05125   |
| ATTID17  | -.20379  | -.07963  | .20610   |
| ATTID18  | -.02716  | -.05436  | .11113   |
| ATTID19  | .01428   | -.07540  | .37949   |
| ATTID20  | .00045   | -.05107  | .41333   |
| ATTID21  | -.05480  | .07037   | .32739   |
| VALID22  | -.10755  | .33590   | -.00909  |
| VALID23  | .07415   | .26991   | .03111   |
| VALID24  | -.14750  | .36244   | -.02421  |
| VALID25  | -.07819  | .30226   | -.09026  |



# PRINCIPAL COMPONENTS ANALYSIS

## SURVEY OF DESIGN

### MANUFACTURERS - IDEAL

#### Factor Score Coefficient Matrix:

|          | FACTOR 1 | FACTOR 2 | FACTOR 3 |
|----------|----------|----------|----------|
| HYID1    | -.05580  | -.03480  | .31729   |
| HYID2    | .07007   | -.00553  | -.18956  |
| HYID3    | -.05580  | -.03480  | .31729   |
| HYID4    | -.10052  | .09797   | -.02531  |
| HYID5    | -.01453  | -.09981  | .00072   |
| FRAGID6  | .16704   | -.05031  | -.05044  |
| FRAGID7  | .04835   | -.03038  | -.00229  |
| FRAGID8  | .04140   | -.11530  | -.05401  |
| FRAGID9  | -.02306  | .31828   | -.04415  |
| FRAGID10 | -.08024  | .16275   | -.02753  |
| BACKID11 | .06338   | -.04985  | .21101   |
| BACKID12 | -.01073  | .03434   | .06050   |
| BACKID13 | -.01445  | .00249   | .08507   |
| BACKID14 | .15052   | -.06260  | -.10834  |
| BACKID15 | -.12768  | -.00496  | .05209   |
| BACKID16 | -.05812  | .24793   | -.10559  |
| ATTID17  | -.03138  | .27972   | .04860   |
| ATTID18  | .10958   | .17922   | -.00689  |
| ATTID19  | .20386   | -.05162  | -.01638  |
| ATTID20  | .20386   | -.05162  | -.01638  |
| ATTID21  | .20386   | -.05162  | -.01638  |
| VALID22  | .06675   | -.13299  | .01824   |
| VALID23  | -.09623  | .18497   | .10865   |
| VALID24  | .04901   | -.08076  | -.08375  |
| VALID25  | -.08036  | -.04323  | .05020   |

# PRINCIPAL COMPONENTS ANALYSIS

## SURVEY OF DESIGN

### STUDENTS - REAL

#### Factor Score Coefficient Matrix:

|          | FACTOR 1 | FACTOR 2 | FACTOR 3 |
|----------|----------|----------|----------|
| HYRE1    | .12162   | .04666   | -.04842  |
| HYRE2    | .02637   | .40686   | -.09890  |
| HYRE3    | .15262   | .23060   | -.14349  |
| HYRE4    | .35413   | -.04743  | .04996   |
| HYRE5    | .04387   | .34861   | -.08672  |
| FRAGRE6  | -.01910  | .04074   | -.04445  |
| FRAGRE7  | -.10315  | -.08767  | -.09008  |
| FRAGRE8  | .02930   | .02408   | .02931   |
| FRAGRE9  | .25928   | -.00369  | -.13876  |
| FRAGRE10 | .28505   | -.01099  | -.05898  |
| BACKRE11 | -.07121  | .00665   | -.10868  |
| BACKRE12 | .17800   | -.01360  | .06708   |
| BACKRE13 | .17750   | -.02703  | .01019   |
| BACKRE14 | -.07268  | -.08842  | .01916   |
| BACKRE15 | -.06364  | -.07618  | -.06260  |
| BACKRE16 | -.06550  | .17598   | -.12989  |
| ATTRE17  | -.26962  | .14877   | .10138   |
| ATTRE18  | -.17582  | .15854   | .02464   |
| ATTRE19  | -.11014  | -.06429  | .02004   |
| ATTRE20  | -.03354  | -.11623  | -.06260  |
| ATTRE21  | .07457   | -.10042  | .21266   |
| VALRE22  | -.04829  | -.06831  | .33604   |
| VALRE23  | .05531   | .11832   | .22321   |
| VALRE24  | .04563   | -.15832  | .42224   |
| VALRE25  | -.08370  | .02981   | .26107   |



# PRINCIPAL COMPONENTS ANALYSIS

## SURVEY OF DESIGN

### LECTURERS - REAL

#### Factor Score Coefficient Matrix:

|          | FACTOR 1 | FACTOR 2 | FACTOR 3 |
|----------|----------|----------|----------|
| HYRE1    | -.06404  | -.07802  | -.01950  |
| HYRE2    | -.08860  | .00884   | -.13503  |
| HYRE3    | -.05083  | -.09225  | -.06110  |
| HYRE4    | -.03108  | .14570   | -.08094  |
| HYRE5    | .20642   | -.10320  | -.08086  |
| PRAGRE6  | -.01286  | -.02667  | .15115   |
| PRAGRE7  | .05895   | .31227   | -.07603  |
| PRAGRE8  | -.13972  | .33525   | -.06709  |
| PRAGRE9  | .19684   | -.02837  | -.09574  |
| PRAGRE10 | .19261   | -.02153  | -.00956  |
| BACKRE11 | .24304   | -.10494  | -.06333  |
| BACKRE12 | -.00970  | .07098   | -.03902  |
| BACKRE13 | .07591   | -.02632  | -.07636  |
| BACKRE14 | .18614   | .11130   | -.07524  |
| BACKRE15 | -.11058  | -.06650  | -.00235  |
| BACKRE16 | -.10863  | .22025   | -.06818  |
| ATTRE17  | -.09466  | .23137   | -.03162  |
| ATTRE18  | -.01281  | .20804   | -.04870  |
| ATTRE19  | .07185   | -.10672  | .25552   |
| ATTRE20  | .06102   | -.09336  | .21026   |
| ATTRE21  | .09510   | -.02780  | .03079   |
| VALRE22  | -.09789  | -.07246  | .40251   |
| VALRE23  | -.10282  | -.04166  | .27006   |
| VALRE24  | .11810   | -.06148  | .16160   |
| VALRE25  | .06034   | -.01877  | .09761   |

# PRINCIPAL COMPONENTS ANALYSIS

## SURVEY OF DESIGN

DESIGNERS - REAL

### Factor Score Coefficient Matrix:

|          | FACTOR 1 | FACTOR 2 | FACTOR 3 |
|----------|----------|----------|----------|
| HYRE1    | -.10661  | .01827   | .38564   |
| HYRE2    | .14285   | .18937   | -.06657  |
| HYRE3    | -.06921  | -.05511  | .26989   |
| HYRE4    | .30203   | -.10538  | -.14428  |
| HYRE5    | -.08043  | -.02558  | .11584   |
| PRAGRE6  | .11702   | -.06123  | .03375   |
| PRAGRE7  | .09654   | -.04046  | -.08521  |
| PRAGRE8  | -.15684  | -.01058  | -.19964  |
| PRAGRE9  | .01027   | -.10210  | .00029   |
| PRAGRE10 | .14716   | -.11611  | -.08152  |
| BACKRE11 | -.11822  | -.04207  | .27147   |
| BACKRE12 | .09157   | -.09993  | .17562   |
| BACKRE13 | .16877   | -.11475  | .10165   |
| BACKRE14 | -.03283  | .10904   | .17642   |
| BACKRE15 | .18489   | .00154   | .04187   |
| BACKRE16 | -.05945  | -.05539  | -.05225  |
| ATTRE17  | -.04872  | -.06845  | -.00324  |
| ATTRE18  | .01752   | -.01851  | -.09896  |
| ATTRE19  | .13702   | .21558   | -.14383  |
| ATTRE20  | .31922   | -.04746  | -.11976  |
| ATTRE21  | -.12377  | .16738   | .15131   |
| VALRE22  | -.02867  | .07999   | -.20508  |
| VALRE23  | -.05748  | .24682   | -.01066  |
| VALRE24  | -.02804  | .30481   | -.03422  |
| VALRE25  | -.17791  | .30927   | -.01083  |



APPENDIX VII

PERCENTAGE "AGREE" RESPONSES

"Agree" responses to Design Survey expressed as percentages.

The following Tables are of percentages of Groups who have scored 5 or 6 (Largely or Definitely Agree).

The relation between IDEAL and REAL has been dealt with in the text in terms of the absolute difference between them. Another possible way of treating this relationship was by means of the ratio between the two. In fact the two measures produced very much the same result.

The following tables give:

A. Percentages of IDEAL and REAL "Agree" responses for the Complete Sample together with Ratio Index and its Rank order and Difference Index and its Rank order. A note of the top and bottom five ranks is added.

B. Percentages of "Agree" responses for the Complete Sample, the Polytechnic Sample (Students & Lecturers), Designer Sample, Manufacturer Sample.

C. The top and bottom five percentages of "Agree" responses for the above samples, giving both the Ratio and Difference indices

A.

COMPLETE SAMPLE

HIGHER ORDER ABILITIES

|                                 | IDEAL | REAL | R/I | Rk | DIFF | Rk |
|---------------------------------|-------|------|-----|----|------|----|
| 1. Understand and develop brief | 99.5  | 79.6 | .8  | 2  | 19.9 | 3  |
| 2. Create new Design concepts   | 92.0  | 61.4 | .67 | 12 | 30.6 | 15 |
| 3. Devise practical concepts    | 93.6  | 62.7 | .67 | 12 | 30.9 | 16 |
| 4. "Sells" design concepts      | 87.3  | 61.2 | .7  | 8  | 26.1 | 8  |
| 5. Conceives alternate concepts | 90.6  | 65.7 | .73 | 6  | 24.9 | 7  |



### PRESENTATION SKILLS

|                          |      |      |     |    |      |    |
|--------------------------|------|------|-----|----|------|----|
| 6. Visual presentation   | 94.5 | 91.6 | .97 | 1  | 2.9  | 1  |
| 7. Oral presentation     | 78.8 | 52.0 | .66 | 14 | 26.8 | 9  |
| 8. Written presentation  | 56.2 | 28.7 | .51 | 20 | 27.5 | 11 |
| 10. Marketing techniques | 60.6 | 31.2 | .51 | 20 | 29.4 | 13 |

### KNOWLEDGE & KNOWHOW

|   |      |      |     |    |      |    |
|---|------|------|-----|----|------|----|
| 9. Knows financial implications                   | 87.2 | 45.1 | .52 | 19 | 42.1 | 23 |
| 11. Understands engineering<br>theory & technique | 88.6 | 59.9 | .68 | 10 | 28.7 | 12 |
| 12. Understand prof law                           | 71.4 | 34.5 | .48 | 22 | 36.9 | 20 |
| 13. Understands business practice                 | 75.3 | 41.8 | .56 | 17 | 33.5 | 18 |
| 14. Understands production method                 | 84.6 | 60.4 | .71 | 7  | 24.2 | 6  |
| 15. Understands market trends                     | 98.6 | 69.2 | .7  | 8  | 29.4 | 13 |
| 16. Knows relevant computing tech                 | 67.8 | 24.9 | .37 | 25 | 42.9 | 24 |

### ATTITUDES AT WORK

|                                   |      |      |     |    |      |    |
|-----------------------------------|------|------|-----|----|------|----|
| 17. Works well with others ID     | 87.6 | 68.9 | .79 | 3  | 18.7 | 2  |
| 18. Works well with other experts | 85.1 | 58.2 | .68 | 10 | 26.9 | 10 |
| 19. Self motivated                | 98.5 | 77.6 | .79 | 3  | 20.9 | 4  |
| 20. Sense of deadlines            | 94.0 | 61.5 | .65 | 15 | 32.5 | 17 |
| 21. Sense of detail               | 95.1 | 60.2 | .63 | 16 | 34.9 | 19 |

### VALUES & ORIENTATIONS

|                       |      |      |     |    |      |    |
|-----------------------|------|------|-----|----|------|----|
| 22. Wide culture      | 69.8 | 28.1 | .4  | 23 | 41.7 | 22 |
| 23. Thinks laterally  | 84.7 | 47.8 | .56 | 17 | 36.9 | 20 |
| 24. Aesthetic         | 86.2 | 65.2 | .76 | 5  | 21.0 | 5  |
| 25. Social conscience | 75.3 | 29.6 | .39 | 24 | 45.7 | 25 |

Two measures of agreement between IDEAL and REAL are used.

1. A ratio of IDEAL to REAL using percentage opting for Def. Agree + Largely Agree within each mode. That is IDEAL/REAL.
2. A straight difference between percentages opting as above. That is IDEAL-REAL.

If one takes the highest five ranks and the lowest five ranks on each of these measures, the following results:

1. Ratio agreement using R/I

|      |     |  |
|------|-----|--|
| 1st  | Q6  | Visual presentation                        |
| 2nd  | Q1  | Understand and develop brief               |
| 3rd  | Q19 | Self motivated                             |
| 3rd  | Q17 | Works well with other Designers            |
| 5th  | Q24 | Aesthetic in outlook                       |
|      |     |  |
| 20th | Q8  | Written presentation                       |
| 20th | Q10 | Knowledge of marketing techniques          |
| 22nd | Q12 | Knowledge of professional law              |
| 23rd | Q22 | Wide cultural interests                    |
| 24th | Q25 | Social conscience                          |
| 25th | Q16 | Knowledge of relevant computing techniques |

2. Difference agreement using I-R

|      |     |   |
|------|-----|---|
| 1st  | Q6  | Visual presentation                       |
| 2nd  | Q17 | Works well with other Designers           |
| 3rd  | Q1  | Understand and develop brief              |
| 4th  | Q19 | Selfmotivated                             |
| 5th  | Q24 | Aesthetic in outlook                      |
|      |     |   |
| 20th | Q23 | Thinks laterally                          |
| 20th | Q12 | Knowledge of professional law             |
| 22nd | Q22 | Wide cultural interests                   |
| 23rd | Q23 | Knowledge of financial implications       |
| 24th | Q16 | Knowledge of relevant computer techniques |
| 25th | Q25 | Social conscience.                        |

The above top and bottom five places are well correlated.



B. "Agree" percentages for all groups

|   |       | Status<br>Groups |      |      |      |
|---|-------|------------------|------|------|------|
|   |       | Total            | 1+2  | 3    | 4    |
| 1. Understand and develop brief                   | IDEAL | 99.5             | 99.4 | 100  | 100  |
|   | REAL  | 79.6             | 79.3 | 76.7 | 87.5 |
| 2. Create new Design concepts etc.                |       | 92.0             | 90.4 | 96.7 | 100  |
|   |       | 61.4             | 59.6 | 60   | 81.3 |
| 3. Devise practical concepts                      |       | 93.6             | 91.7 | 100  | 100  |
|   |       | 62.7             | 64.7 | 51.7 | 87.5 |
| 4. "Sells" design concepts                        |       | 87.3             | 79.3 | 80   | 53   |
|   |       | 61.2             | 64.5 | 53.3 | 81.3 |
| 5. Conceives alternative concepts                 |       | 90.6             | 89.8 | 93.1 | 94.1 |
|   |       | 65.7             | 66.6 | 58.3 | 68.8 |
| 6. Visual presentation                            |       | 94.5             | 94.8 | 93.4 | 94.1 |
|   |       | 91.6             | 93.0 | 96.6 | 87.5 |
| 7. Oral presentation                              |       | 78.8             | 75.7 | 93.3 | 82.3 |
|   |       | 52.0             | 59.7 | 30.0 | 62.6 |
| 8. Written presentation                           |       | 56.2             | 51.3 | 76.7 | 64.7 |
|   |       | 28.7             | 31.4 | 20.0 | 18.8 |
| 9. Knows financial implications                   |       | 87.2             | 86.5 | 96.7 | 76.4 |
|   |       | 45.1             | 53.8 | 23.4 | 62.5 |
| 10. Knows marketing techniques                    |       | 60.6             | 59.6 | 70.0 | 52.9 |
|   |       | 31.2             | 39.1 | 10.0 | 37.6 |
| 11. Understands engineering theory and techniques |       | 88.6             | 85.9 | 100  | 94.2 |
|   |       | 59.9             | 59.6 | 60.0 | 62.5 |
| 12. Understand professional law                   |       | 71.4             | 72.4 | 83.0 | 41.2 |
|   |       | 34.5             | 38.4 | 26.0 | 35.7 |
| 13. Understands business practice                 |       | 75.3             | 74.3 | 86.7 | 64.7 |
|   |       | 41.8             | 47.7 | 30.0 | 75.1 |
| 14. Understands production method                 |       | 84.6             | 80.8 | 100  | 93.8 |
|   |       | 60.4             | 64.7 | 46.6 | 81.3 |
| 15. Understands market trends                     |       | 98.6             | 89.7 | 86.7 | 93.8 |
|   |       | 69.2             | 73.0 | 63.4 | 53.3 |

|                                   |      |      |      |      |
|-----------------------------------|------|------|------|------|
| 16. Knows relevant computing tech | 67.8 | 66.7 | 73.3 | 68.8 |
|                                   | 24.9 | 24.3 | 30.0 | 46.7 |
| 17. Works well with others ID     | 87.6 | 87.2 | 83.4 | 100  |
|                                   | 68.9 | 69.2 | 70.0 | 62.5 |
| 18. Works well with other experts | 85.1 | 94.3 | 100  | 94.1 |
|                                   | 58.2 | 58.1 | 56.7 | 62.5 |
| 19. Self motivated                | 98.5 | 99.4 | 96.6 | 94.1 |
|                                   | 77.6 | 80.6 | 60.0 | 81.3 |
| 20. Sense of deadlines            | 94.0 | 94.8 | 96.7 | 94.1 |
|                                   | 61.5 | 63.6 | 56.6 | 50.1 |
| 21. Sense of detail               | 95.1 | 94.9 | 96.7 | 94.1 |
|                                   | 60.2 | 60.0 | 60.0 | 62.6 |
| 22. Wide culture                  | 69.8 | 71.8 | 70.0 | 50.0 |
|                                   | 28.1 | 25.9 | 30.0 | 46.7 |
| 23. Thinks laterally              | 84.7 | 81.2 | 96.7 | 94.1 |
|                                   | 47.8 | 47.1 | 53.4 | 43.8 |
| 24. Aesthetic                     | 86.2 | 86.5 | 93.4 | 82.4 |
|                                   | 65.2 | 64.5 | 70.0 | 62.6 |
| 25. Social conscience             | 75.3 | 81.4 | 60.0 | 43.8 |
|                                   | 29.6 | 27.9 | 36.7 | 33.3 |

C. "Agree" percentages for top and bottom by Ratio and Difference Indices for Status groups.

1. Students & Lecturers ( Polytechnic sample)

a. Ratio index

|       |     |                                  |     |
|-------|-----|----------------------------------|-----|
| 1st   | Q6  | Visual presentation              | .98 |
| 2nd   | Q15 | Understands market trends        | .81 |
| 3rd   | Q4  | "Sells" design concept to client | .81 |
| 4th   | Q19 | Selfmotivated                    | .81 |
| 5th   | Q14 | Understand prod. methods         | .80 |
| ..... |     |                                  |     |
| 21st  | Q23 | Thinks laterally                 | .58 |
| 22nd  | Q12 | Understands prof law             | .53 |
| 23rd  | Q16 | Relevant computer technique      | .36 |
| 24th  | Q22 | Wide cultural interests          | .36 |
| 25th  | Q25 | Social conscience                | .34 |



b. Difference index

|     |     |                          |      |
|-----|-----|--------------------------|------|
| 1st | Q6  | Visual presentation      | 1.8  |
| 2nd | Q15 | Understands market trend | 14.7 |
| 3rd | Q4  | "Sells" design concept   | 14.8 |
| 4th | Q14 | Understands prod methods | 16.1 |
| 5th | Q18 | Selfmotivated            | 18.8 |

|      |     |                             |      |
|------|-----|-----------------------------|------|
| 21st | Q12 | Understands prof law        | 34.0 |
| 22nd | Q23 | Thinks laterally            | 34.1 |
| 23rd | Q16 | Relevant computer technique | 42.4 |
| 24th | Q22 | Wide cultural interests     | 45.9 |
| 25th | Q25 | Social conscience           | 53.5 |

2. Designers

a. Ratio index

|     |     |                                 |     |
|-----|-----|---------------------------------|-----|
| 1st | Q6  | Visual presentation             | .93 |
| 2nd | Q17 | Works well with other Designers | .84 |
| 3rd | Q1  | Understand & dev client's brief | .77 |
| 4th | Q15 | Understands market trends       | .73 |
| 5th | Q25 | Social conscience               | .61 |

|      |     |                                 |     |
|------|-----|---------------------------------|-----|
| 21st | Q13 | Understands business practice   | .34 |
| 22nd | Q7  | Oral presentation               | .32 |
| 23rd | Q12 | Understands prof law            | .31 |
| 24th | Q9  | Understands financial           | .24 |
| 25th | Q10 | Skilled in marketing techniques | .14 |

b. Difference index

|      |     |                                 |      |
|------|-----|---------------------------------|------|
| 1st  | Q6  | Visual presentation             | 6.8  |
| 2nd  | Q17 | Works well with other Designers | 13.4 |
| 3rd= | Q1  | Understand & dev client's brief | 23.3 |
| 3rd= | Q15 | Understands market trends       | 23.3 |
| 3rd= | Q25 | Social conscience               | 23.3 |

|      |     |                               |      |
|------|-----|-------------------------------|------|
| 21st | Q13 | Understands business practice | 53.7 |
| 22nd | Q12 | Understand prof law           | 57.0 |

|      |     |                                    |      |
|------|-----|------------------------------------|------|
| 23rd | Q10 | Skilled marketing techniques       | 60.0 |
| 24th | Q7  | Oral presentation                  | 63.3 |
| 25th | Q9  | Understands financial implications | 73.3 |

### 3. Manufacturers

#### a. Ratio Index

|       |     |                                 |     |
|-------|-----|---------------------------------|-----|
| 1st   | Q22 | Wide cultural interests         | .93 |
| 2nd   | Q6  | Visual presentation             | .93 |
| 3rd   | Q1  | Understand & dev client brief   | .87 |
| 3rd=  | Q3  | Devise practical designs        | .87 |
| 5th   | Q12 | Understand professional law     | .85 |
| ..... |     |                                 |     |
| 21st  | Q17 | Works well with other Designers | .62 |
| 22nd  | Q15 | Understands market trends       | .57 |
| 23rd  | Q20 | Works to deadlines              | .53 |
| 24th  | Q23 | Thinks laterally                | .46 |
| 25th  | Q8  | Written presentation            | .29 |

#### b. Difference Index

|       |     |                                 |      |
|-------|-----|---------------------------------|------|
| 1st   | Q22 | Wide cultural interests         | 3.3  |
| 2nd   | Q12 | Understand professional law     | 5.5  |
| 3rd   | Q6  | Visual presentation             | 6.6  |
| 4th   | Q25 | Socially concerned              | 10.5 |
| 5th   | Q1  | Understand & dev client brief   | 22.5 |
| 5th=  | Q3  | Devise practical designs        | 22.2 |
| ..... |     |                                 |      |
| 21st  | Q17 | Works well with other Designers | 37.5 |
| 22nd  | Q15 | Understands market trends       | 40.5 |
| 23rd  | Q20 | Works to deadlines              | 44.0 |
| 24th  | Q8  | Written presentation            | 45.9 |
| 25th  | Q23 | Thinks laterally                | 50.3 |



APPENDIX VIII

INDICES OF SELECTIVITY & SENSITIVITY

## Indices of Selectivity and Sensitivity

The following items from the Survey of Design were found significant in distinguishing Domain A (Commercial) from Domain B (Educational). It is to be noted that the raw scores which ranged from 1 to 6 were recoded to the requirements of the MSA1 program into binary form above and below the median which applied to the particular item in question.

### IDEAL

Item 1. The Industrial Designer should be skilled in understanding and developing a client's brief.

|                | Selectivity | Sensitivity |
|----------------|-------------|-------------|
| A Below median | 0.0         | 0.0         |
| Above median   | 1.0         | 0.66        |
| B Below        | 0.32        | 1.0         |
| Above          | 0.68        | 0.34        |

Item 3. The Industrial Designer should be skilled in devising practical Design concepts.

|         |      |      |
|---------|------|------|
| A Below | 0.07 | 0.18 |
| Above   | 0.93 | 0.66 |
| B Below | 0.42 | 0.82 |
| Above   | 0.59 | 0.34 |



Item 5. The Industrial Designer should be skilled in conceiving alternative Design solutions.

|         |      |      |
|---------|------|------|
| A Below | 0.20 | 0.39 |
| Above   | 0.80 | 0.65 |

|         |      |      |
|---------|------|------|
| B Below | 0.62 | 0.61 |
| Above   | 0.38 | 0.35 |

Item 7 The Industrial Designer should be skilled in presenting Design concepts verbally.

|          |      |      |
|----------|------|------|
| A2 Below | 0.28 | 0.22 |
| Above    | 0.72 | 0.57 |

|            |      |      |
|------------|------|------|
| A1+B Below | 0.60 | 0.78 |
| Above      | 0.40 | 0.43 |

Item 9 The Industrial Designer should be skilled in understanding the financial implications of Design decisions.

|         |      |      |
|---------|------|------|
| A Below | 0.24 | 0.29 |
| Above   | 0.77 | 0.77 |

|         |      |      |
|---------|------|------|
| B Below | 0.74 | 0.71 |
| Above   | 0.26 | 0.23 |

Item 10 The Industrial Designer should be skilled in marketing techniques.

|         |      |      |
|---------|------|------|
| A Below | 0.20 | 0.27 |
| Above   | 0.80 | 0.75 |

|         |      |      |
|---------|------|------|
| B Below | 0.65 | 0.73 |
| Above   | 0.35 | 0.25 |

Item 11 The Industrial Designer should have an understanding of relevant engineering theory and technique.

|         |      |      |
|---------|------|------|
| A Below | 0.27 | 0.32 |
| Above   | 0.73 | 0.71 |

|         |      |      |
|---------|------|------|
| B Below | 0.68 | 0.68 |
| Above   | 0.32 | 0.29 |

Item 14 The Industrial Designer should have an understanding of relevant volume production processes.

|         |      |      |
|---------|------|------|
| A Below | 0.27 | 0.32 |
| Above   | 0.73 | 0.77 |

|         |      |      |
|---------|------|------|
| B Below | 0.74 | 0.68 |
| Above   | 0.26 | 0.23 |

Item 15 The Industrial Designer should have an understanding of current market trends.

|         |      |      |
|---------|------|------|
| A Below | 0.37 | 0.45 |
| Above   | 0.63 | 0.60 |

|         |      |      |
|---------|------|------|
| B Below | 0.50 | 0.55 |
| Above   | 0.50 | 0.40 |

Item 16 The Industrial Designer should have an understanding of relevant computer techniques.

|          |      |      |
|----------|------|------|
| A2 Below | 0.07 | 0.08 |
| Above    | 0.93 | 0.53 |

|            |      |      |
|------------|------|------|
| B+A1 Below | 0.52 | 0.92 |
| Above      | 0.48 | 0.47 |



Item 18 The Industrial Designer should collaborate well with experts from other areas.

|         |      |      |
|---------|------|------|
| A Below | 0.05 | 0.17 |
| Above   | 0.95 | 0.62 |
| B Below | 0.30 | 0.83 |
| Above   | 0.70 | 0.38 |

Item 20 The Industrial Designer should work successfully to dead lines.

|         |      |      |
|---------|------|------|
| A Below | 0.05 | 0.12 |
| Above   | 0.95 | 0.68 |
| B Below | 0.44 | 0.88 |
| Above   | 0.56 | 0.32 |

Item 21 The Industrial Designer should pay attention to detail.

|         |      |      |
|---------|------|------|
| A Below | 0.05 | 0.11 |
| Above   | 0.95 | 0.67 |
| B Below | 0.47 | 0.89 |
| Above   | 0.53 | 0.33 |

Item 23 The Industrial Designer should think laterally.

|            |      |      |
|------------|------|------|
| A2 Below   | 0.04 | 0.07 |
| Above      | 0.96 | 0.57 |
| B+A1 Below | 0.54 | 0.93 |
| Above      | 0.46 | 0.43 |

# REAL

Item 8. The Industrial Designer is skilled in presenting Design concepts in writing.

|              | Selectivity | Sensitivity |
|--------------|-------------|-------------|
| Domain A     |             |             |
| Below Median | 0.59        | 0.65        |
| Above Median | 0.41        | 0.19        |

|              |      |      |
|--------------|------|------|
| Domain B     |      |      |
| Below Median | 0.16 | 0.35 |
| Above Median | 0.84 | 0.81 |

Item 9. The Industrial Designer is skilled in understanding the financial implications of Design decisions.

|          |      |      |
|----------|------|------|
| A. Below | 1.0  | 0.52 |
| Above    | 0.0  | 0.0  |
| B. Below | 0.51 | 0.48 |
| Above    | 0.49 | 1.0  |

Item 10. The Industrial Designer is skilled in marketing techniques.

|          |      |      |
|----------|------|------|
| A. Below | 0.65 | 0.60 |
| Above    | 0.35 | 0.20 |
| B. Below | 0.23 | 0.40 |
| Above    | 0.78 | 0.80 |



Item 13. The Industrial Designer has an understanding of normal business practice.

|          |      |      |
|----------|------|------|
| A. Below | 0.88 | 0.49 |
| Above    | 0.12 | 0.12 |
| B. Below | 0.49 | 0.51 |
| Above    | 0.51 | 0.88 |

# LIST OF SPECIAL ABBREVIATIONS USED IN THE TEXT

|           |   |
|-----------|---|
| A         | Attitudes at Work                                 |
| ANX       | Neuroticism (in EPQ)                              |
| B         | Business Studies                                  |
| CLASS     | Class of degree in BA Industrial Design           |
| DOM       | Dominant Value (in SSV)                           |
| EPQ       | Eysenck Personality Questionnaire                 |
| EXT       | Extraversion (in EPQ)                             |
| FA        | Fine Arts   |
| H         | Higher Order Abilities (in SD)                    |
| HAV       | Higher Order Abilities, Attitudes at Work, Values |
| I         | Educational Institution                           |
| ID        | Industrial Design                                 |
| K or KNOW | Knowledge or Knowhow (in SD)                      |
| M         | Mathematics                                       |
| MCM       | Meta Conceptual Model                             |
| MDS       | Multidimensional Scaling                          |
| MSA       | Multidimensional Scalogram Analysis               |
| P         | Presentational Skills (in SD)                     |
| PRES      | Presentational Skills (in SD)                     |
| PRG       | Pragmatic value (in SSV)                          |
| PRT       | Pattern Recognition Test                          |
| S         | Social Work                                       |
| SD        | Survey of Design                                  |
| SOC       | Social Value (in SSV)                             |
| SSA       | Smallest Space Analysis                           |
| SSV       | Solomons' Survey of Values                        |
| THEO      | Theoretic Value in (SSV)                          |
| UCM       | User Conceptual Model                             |
| V or VAL  | Values and Orientations (in SD)                   |
| VERB      | Verbal Presentational Skills (in SD)              |
| VIS       | Visual Presentational Skills (in SD)              |
| VVK       | Visual Skills, Verbal Skills, Knowhow             |